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Hearings. v. 4-6, 1958.

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ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

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ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary, commencing Monday, February 3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.

Mr. Miles H. Patterson.

Mr. J.F. Parkinson -- Secretary to the Commission.

Major N. Lafrance -- Assistant Secretary to the Commission.

APPEARANCES:

Representing The City of Calgary:

Mr. S.J. Helman, Q.C., and
Mr. E. Bredin, Q.C.

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Friday,
February 7, 1958

---On resuming at 9.45 A.M.

Submission of

THE CITY OF CALGARY

APPEARANCES:

Mr. Samuel J. Helman, Q.C. and

Mr. E. Bredin, Q.C.

---Mr. Commissioner Ladner was not present.

THE CHAIRMAN: Gentlemen, we will resume the hearings of the Commission but, before proceeding with the brief of the City of Calgary, I would like to make a statement, for the benefit of those concerned. The Commission has considered the question of when a brief being submitted to it becomes, you might say, public property and has come to the conclusion that the only practical way to deal with that matter is that when a brief is being read, starts to be read, the whole of the brief becomes public property. If there are changes in it, it is up to those concerned and the members of the press to find those changes, and that is how we will have to deal with the matter, for the time being.

Now, Mr. Pattillo.

MR. PATTILLO: Mr. Chairman, the City of Calgary is submitting a brief this morning. I am hoping that -- have copies been submitted to the Commissioners?

THE CHAIRMAN: No, sir.

MR. PATTILLO: Mr. Bredin, have you a number of copies?

MR. BREDIN: Yes.

MR. PATTILLO: Mr. F.J. Helman, Q.C. is appearing as counsel for the City of Calgary and he has, with him, Mr. E.M. Bredin, Q.C., who is the City Solicitor. I do not know which one of these gentlemen or who is going to read the submission, but I will ask Mr. Helman to deal with it.

MR. HELMAN: Mr. Chairman and Members of the Commission, as Mr. Pattillo said, I am appearing with Mr. Bredin, and we are acting for the City of Calgary and the other communities receiving gas from The Canadian Western Natural Gas Company and, for convenience, I will confine my remarks to the City of Calgary; but it will be understood that it includes the whole system.

May I say, at the outset, that Calgary is not opposed to the export of gas to the United States, but it will be demonstrated that there may not be sufficient present serves to supply the gas to Calgary and the requirements of the Trans-Canada Company for

its Canadian market.

The presentation which will be made roughly divides itself into three phases. First, it is submitted that Calgary is entitled to obtain supplies of gas from those gas fields which are the natural sources of supply; that is, from fields in the neighbourhood of the Canadian Western Transmission system.

From the material already filed it appears that it is from these very fields, as well as the fields which are the natural source of supply for the Northwestern Utilities, that the exporting companies propose to take gas. These exporting companies pay lip service, however, to the idea that they are protecting the Alberta and Canadian consumers and that they are giving priority to them. With regard to the Alberta consumers, it will be seen that, while exhausting the fields in the neighbourhood of the Alberta consumers, their proposals provide that the Alberta consumers will have a prior call on gas at any time they require it. In the result, the Alberta consumers will only receive gas in a small proportion from the fields in the vicinity of the communities requiring it and will be forced to obtain their future supplies from further and more distant fields. This will add to the cost of such gas the extra transmission charges from such distant places, the increased cost of deep drilling which it will be shown these

distant places require, apart altogether from the increased cost of gas which has already taken place at the wellhead due to the competition of exporting companies.

It is submitted that the setting aside of these fields in the vicinity of the Canadian Western line does not mean, as has been suggested, that the owners of the gas in these fields will be deprived of their full revenue, because Calgary -- and I am, again, referring to the system -- can make ample use, as will be explained by our witness, of the fields we require and, indeed, additional sources of gas will have to be found and made available, in due course, to allow for the probable growth of the City of Calgary.

While, as I have said, Calgary does not object to the export of gas, provided it is taken from sources which are not the natural source of supply for Calgary, it will be demonstrated that the available gas, having regard to the sulphur and oil markets, is far smaller than the reserve figures which have already been given after due allowance has been made in addition for the availability of such gas. It will be seen that at the present time, while there may be sufficient gas for Alberta consumers, there is a serious problem as to the sufficiency of reserves for the consumers in the whole of Canada, without considering the export to the

United States.

At this stage of the proceedings I only intend to call the chief gas expert for the City, namely, Stanley J. Davies, and Mr. Martin, our town planner, who will deal with population figures; and I would like some time reserved, later in the hearing, for two other witnesses, namely, Professor Flock, of the University of Alberta, and Mr. Workman, our geologist, and, as the hearing proceeds, it will be probably necessary for me to recall Mr. Davies by way of rebuttal.

May I say, before I put Mr. Davies in the box, that the citizens of Calgary feel that the problem of its gas supply is of the most vital importance to them and that the loss of an adequate supply, at fair prices -- that is, prices not inflated by export requirements -- would be a severe blow, indeed, to the future growth of this community.

Now, we have filed, in addition to the material that we placed before the Oil and Gas Conservation Board, a submission to this Royal Commission on Energy and it opens up by giving a biolgraphical statement of Mr. Davies' qualifications, which I would now like to read.

Stanley J. Davies, P. Eng., gradutated in 1921 from the Royal School of Mines, Imperial College of Science, London, England, in Technology of Oil. Worked as geologist and petroleum engineer in Roumania,

Trinidad, Mexico, California, from 1921 to 1924. 1925, Petroleum Engineer for Department of Interior at Calgary. 1926 to date, Consulting Petroleum Engineer.

Represented the City of Calgary at hearings and rate cases in 1926, 1931, 1939, 1945, 1949, 1953, and the City of Edmonton in 1951.

Appeared for Imperial Oil before the McGillivray Commission, 1938. That was a Commission dealing with problems of oil in Alberta.

Appeared for independent producers on conservation of natural gas in Turner Valley, 1931 to 1934.

Member of the Association of Professional Engineers, Engineering Institute of Canada. Honorary member, Alberta Society of Petroleum Geologists. Life member, Canadian Institute of Mining and Metallurgy.

Now, the points that Mr. Davies is going to deal with are contained in a letter which follows immediately, which he wrote to me and also to Mr. Bredin, and I propose that if I read that to the Commission and then have him explain these various items that are contained in there, that will place before the Commission, as briefly as we can, the viewpoint of the City of Calgary.

"February 1, 1958

"S.J. Helman, Q.C.,
"800 Lancaster Building,
"Calgary, Alberta.

"Reference City of Calgary Submission to
"the Royal Commission on Energy.

"Dear Sir:-

"The points upon which the City of "Calgary and consumers of gas in Southern "Alberta seek assurance are herewith res- "pectfully submitted.

"1. All reserves of natural gas now con- "nected to the present Canadian Western "Natural Gas Company system should be kept "for consumers of gas on that system.

"2. All gas fields adjacent to Calgary, "or adjacent to the transmission lines of "the Canadian Western Natural Gas Company "should be dedicated for the future use of "Southern Alberta consumers of gas.

"3. The pipe lines, treating plants, and "other physical assets now used to supply "gas to Canadian Western consumers should "be used to the fullest possible extent "for as long a period of time as the "economics of the situation warrant.

"4. Consumers of natural gas in Southern "Alberta should not be charged with costs "relating to the production of sulphur or

"other products. The present and future "status of the market and price of sul- "phur is not known, and the present market "for crude oil is restricted. Both sulphur "and crude oil production affect the volume "of gas available for use as fuel.

"5. The sweet gas reserves of the Pro- "vince of Alberta are limited. They should "in general be reserved for Canadian con- "sumption.

"6. The reserves of low acid and low Hydro- "gen Sulphide gas are likely to be more "abundant than those of sweet gas. These "reserves should also be reserved for "Canadian consumption.

"7. Export of natural gas to the United "States should be based on gas from high "acid gas reserves. The problem of find- "ing a market for the very large production "of sulphur from these reserves should be "considered before any permit is granted.

"8. Present proven reserves of natural "gas adjacent to Calgary should not be "included in any export permit. Exhaus- "tion of these reserves means that more "new reserves must be found a greater "distance from Calgary with corresponding "high cost to consumers of gas in Calgary

"and Southern Alberta.

"9. The price of gas to Canadian con-
"sumers and specifically to Southern
"Alberta consumers, should not be higher,
"than costs of production and a fair re-
"turn on capital warrant. Export corpora-
"tions are competing with each other for
"supplies of gas for export to the United
"States.

"10. Contracts between producers of gas and
"a foreign export company covering an area
"of the Province of Alberta from the 5th
"Meridian north to township 57, together
"with the location of a 36 inch diameter
"pipe line with a capacity of 800 million
"cubic feet per day, would decide for many
"years the market outlet for a large part
"of the gas reserves of the Province of
"Alberta. A permit granted to such a cor-
"poration might well place the control of
"a large part of future discoveries of gas
"for all time in the hands of a foreign
"corporation. Such a permit should not be
"used as a method of creating a monopoly
"over gas reserves and the sale of gas from
"a large part of Alberta.

"In explanation of the points enum-
"erated the market for natural gas in

"Canada is a large one. Domestic con-
"sumers in Calgary each use 215 thousand
"cubic feet a year on the average. This
"is much higher than the amount used per
"year per domestic consumer in California.
"The problem, however, is that the Canadian
"consumer uses the gas in large volume in
"the five cold winter months. Pipe lines,
"distribution lines, treating plants, and
"the volume of gas produced by wells must
"be large enough to satisfy the demands of
"the consumers on the coldest day in winter.
"Storage fields, and interruptible con-
"sumers help to modify the demand; but it
"remains a large factor in the natural gas
"business in Canada...... "

The load factor in the State of California is more favourable than that of Calgary due to the difference in climatic conditions. Calgary consumers of gas cannot compete for gas supplies with consumers of gas in Canada in winter months. Some form of protection for Canadian consumers is absolutely essential.

Sweet gas fields may be produced at a rate which fits the demand for gas in Canada. A large volume of production may be permitted by the Oil and Gas Conservation Board in winter, and production may be restricted in summer. Low acid gas fields must be treated to remove hydrogen sulphide and carbon dioxide. Where the percentages of these impurities are small the production from wells may be permitted by the Oil and Gas Conservation Board to meet the market demand for gas. For this reason these fields are suitable reserves to supply the low load factor Canadian market.

High acid gas fields require high cost treating plants. Methane is frequently less than 50 per cent of the gases passing through the plant. The sulphur production valued at $20.00 a ton may be several times the value of the by-product gas which may be sold as fuel.

Gas from plants treating high acid gas is more adapted to the United States market because of the higher load factor. In order to keep costs

down these plants must operate at a high daily rate of capacity, or at a high load factor. Canadian consumers should not be forced to pay higher rates for gas in order to purchase by-product gas from what are in reality sulphur plants. For the same reason Canadian consumers should not be required to pay a high penalty to purchase gas from a pipe line transporting gas to the United States; or in the alternative be required to pay a high price for peak load gas in order to purchase gas from an export pipe line at a high load factor.

An analysis, Table A, of the gas reserves has been prepared covering the Province of Alberta. The data has been taken, in large measure from the 31 January 1957, Report of the Oil and Gas Conservation Board. The additional information provided by the Board is acknowledged with thanks.

Table B is the same type of analysis applied to the reserves of gas adjacent to the City of Calgary, with two storage fields east of Lethbridge.

A brief has been prepared by the City of Calgary for submission to the Oil and Gas Conservation Board of Alberta for its consideration at a future hearing. This brief is submitted to the Royal Commission on Energy for its information as to the detailed problems facing consumers of gas in the City of Calgary and Southern Alberta. These problems have arisen because of applications for

permits to export natural gas to the United States.

Now, I am going to come back, Mr, Chairman and gentlemen, to the various points that are raised there, and have them explained subsequently by the witness, Mr. Davies, whom I now propose to call, and I want to go through with him the tables that are attached.

MR. PATTERSON: Might the brief which Mr. Helman has just read become Exhibit C-7-1, and I suggest that, perhaps, the submission to the Oil and Gas Conservation Board referred to therein become Exhibit C-7-1-A.

THE CHAIRMAN: Yes.

---EXHIBIT NO. C-7-1: Submission of the City of Calgary.

---EXHIBIT NO. C-7-1-A: Submission of City of Calgary to the Oil and Gas Conservation Board.

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STANLEY J. DAVIES, called

BY MR. HELMAN:

Q. Mr. Davies, would you take the submission, Exhibit C-7-1, which is the one with the yellow covers -- you can sit down, I think.

THE CHAIRMAN: Oh, yes.

MR. HELMAN: Q. Yes. Would you just

explain what Table A is. I think Table A goes from page 1 to page 14. What have you tried to show by that table?

A. Table A, page 1, in column 1 shows the name of the field as designated by the Oil and Gas Conservation Board. Column 2 indicates the geological age and the zone in the particular formation from which the production is coming. This column becomes of more importance as we go along, and I wish to come back to column 2 when we are considering the total figures for the whole of the Province, but in the first instance I wish to draw your attention, sirs, to the field Acheson, geological age, Cretaceous, and then over to column 17 and the notation under that "BCF", meaning billions of cubic feet, and you get the figures 10 and 49, and as I go through the tables, generally speaking, the Cretaceous rocks cover the eastern three-quarters of Alberta and contain more sweet gas than any other formation in the Province. Some of the wells are very old, going back to 1898, but the wells are small and it is my opinion that a great deal of the sweet gas reserves have already been discovered. That is not to say there are not more fields to be found, but they are small and scattered, and for that reason it is possible that they are beyond economic reach. That is a classification under column 11.

Q. Would you just pause for a moment, Mr.

Davies? I think, perhaps, you should go through and explain all the headings?

A. Column 3 is the estimated original gas in place -- that is, within the formation itself and in the ground; the amount of gas that has been estimated by the Board. Perhaps I could qualify that a bit by saying they are the figures given or published by the Board as the amounts of gas in place originally. In regard to some of these figures in that column where production has been taken I have taken not the original discovery figures but the figures as given by the Board at the date that the report was compiled on the 31st January, 1957. Subsequently, and before this Commission, the Board has submitted a new report, and from time to time I will mention the changes the Board has made in its estimated reserves.

Column 4 is the discount for reservoir loss. That is, all of the gas in the ground is not going to come out, and for the amount of gas that is going to be left in the ground the 20 per cent is taken off. Now, at the surface after the gas has come to the surface there is another loss. You dry gas -- that is, it has no acid gases in it, and no light fractions in it. The loss is small. Actually it is 5 per cent in the case of the Acheson field and Viking, and is accounted for by fuel and measurement losses in the field itself.

Column 6 is a factor which is used in order to bring all of these figures to one even basis. Some of the gas in the Province has a heat content of up to 1400 BTU's, others 1200 BTU's, and the dry gas fields are down to just under a thousand BTU's, so in order to bring them all to an even basis of 1000 BTU's per cubic foot so that we are all talking about the same kind of units the Board has put in a factor to bring them all to the same basis.

Column 7 is the net amount produced as of the 31st December, 1957. We have that figure complete. That figure is as complete as I can make it to the end of last year.

Column 8 is the same figure as given by the Board in their presentation of disposable gas.

Now, from there on, columns 9, 10 and to the end are new columns which have been prepared with the idea that it may be of some assistance to the Commission and give an idea of what kind of reserves are available within the Province of Alberta. Just to say "gas reserves" is not enough. It is necessary to divide them up and say what kind of reserves, and this is an attempt to place before the Commission the facts with regard to the different classes of reserves within the Province of Alberta.

Column 9 is the available supply for Alberta utilities. Where a gas field is close to

Edmonton, say, it has been allotted to Northwestern Utilities; where a gas field is close to Calgary it has been allotted to Calgary; where a gas field is close to Medicine Hat it has been allotted to Medicine Hat.

Column 10 is the estimated requirement of Alberta utilities for use and for deliverability. The use is calculated from the population graphs and trends. We know what has been used in the past, and from the amount used per customer and per capita we can calculate what amount of gas will be used over the next thirty years. The error -- and there are bound to be errors, Mr. Chairman -- is whether our prophecy is right or wrong, but we have made a very earnest effort to put all the facts together, and Mr. Martin, Town Planner for the City, will appear before you and give his estimated population trends and the reason why he has provided for a growth in Lethbridge at a more rapid rate than in the towns in between, and he will tell you what rate of growth he has provided for Calgary. Upon those figures data for the consumption of gas in the future may be calculated, and this column 10 is the column in which, at the end of the tables, all those figures are collected together.

Column 11 is headed "Beyond Economic "each". They are the small fields I mentioned previously that might have 25 billion feet, but

be 40 miles from a pipe line or from a market, and it does not pay to build a pipe line for that amount of gas.

Column 12 is the reserve committed to export. There are a number of export permits which have been granted -- a number of export permits have been granted. This column will include more gas than is in the export permits for the simple reason -- there is a map at the beginning of this. Just turn back one page and you will find it, and I believe it is shown on this large map here, but with regard to any small field in the area close to, say, Cessford, it is quite obvious that no other large line is going to go in to take gas from any small field close to the Trans-Canada gathering system, or the system that is gathering gas for Trans-Canada, so I have allotted these reserves which are close to the grid lines serving Trans-Canada to Trans-Canada. Similarly, and in the same way, those areas in the northwestern part of the Province which are close to Westcoast Transmission have been allotted to Westcoast Transmission, and those in the extreme southern part of the province -- those reserves close to Montana Power -- have been allotted to Montana Power.

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Now, we have another column 13, marketable gas for available export. I wish to say here I do not have the figures of future demand for Trans-Canada. I do have the figure that was in their permit, and it may be that when Trans-Canada, after the consumption figures are known, that it will, of course, alter the total under column 13.

Under column 14 I have now divided the gas, all gas, into three different classifications following the example of the Board, that is, the Oil and Gas Conservation Board.

The first one is solution gas; solution gas may be defined as that gas which is in solution in the oil and it does not become available until the oil is produced.

Associated gas is gas which is associated with crude oil production. It is often referred to gas cap gas loss above the oil, and in order to conserve the amount of oil that may be recovered as a matter of conservation, the gas cap gas or associated gas is not available until the oil had been produced. For that matter, it is in the hands of the Oil and Gas Conservation Board.

We then come, in the City's case, to Exhibit C-7-1-A. I just refer to it now, briefly. The gas, with regard to the oilfields from Sundre to Calgary -- that is about 60 miles northwest of Calgary to 20 miles north of Calgary -- there is a very consider-

able amount of gas reserves there, but they will not become available for, probably, fifteen years and we have provided a paper written by a Mr. Hemphill which illustrates how much oil has been produced, how much the reserves are and, on the basis of present marketing quotas, it is obvious it will take a very long time to produce the oil from the gasfields some 20 miles to 60 miles north of Calgary, so associated and solution gas are, therefore, very important factors but they cannot be considered available for fuel at this particular date.

We then come to column 16, which is non-associated gas, and this column includes all the gas that is available for use in Canada and elsewhere. I should add one factor with regard to solution gas; solution gas is produced with the oil and to the extent it is produced is, of course, available as fuel.

We come to columns 17, 18 and 19, which is another classification; the first one being sweet gas. Now, sweet gas is gas that does not have any acid in it. It might have light fractions, like ethane, propane or one of the other of the butanes. It does not have carbon dioxide or hydrogen sulphide. Low acid and low hcf hydrogen sulphide content is gas and, arbitrarily, I have divided it on the basis of 5 per cent. Those below 5 per cent. I have called low acid and those above 5 per cent. hydrogen sulphide

I have called high acid gases.

Column 20 gives the reserves of sulphur at 100 per cent. recovery in long terms. You will find a few instances through here in which, approximately, amounts of sulphur have been included, but it was more to indicate that it would not be worthwhile to build a plant for such a small amount of sulphur with any idea of recovering the sulphur.

The tabulations on all the pages through here are done in alphabetical order and it is a complete tabulation so the Board would know it has a complete picture before it, and I would like to now turn to this summary which is on page 14.

MR. HELMAN: Might I say, Mr.Chairman, there are just some misprints in here in some of the small type on the page. Where it says T.C., it says Trans-Canal and it should be Trans-Canada. Then a little further down it says column 17 and 18 and this should be columns 18 and 19.

THE CHAIRMAN: Thank you.

MR. HELMAN: And a little further down, four lines, it says light hydrocarbons, propane, and the next word should be butane and not britane.

MR. DAVIES: There was no significance to the quantities on each page; it just happens that was the amount we could get in calculating it all out, and the important statement is page 14, and here we deal with the totals for the whole of

the Province, and we have done this work with the idea it would be of some value to the Commission in looking at the whole question of reserves from every point of view.

The original estimated gas in place is 32,594 billion cubic feet.

THE CHAIRMAN: Will you translate that into trillions for us?

MR. DAVIES: 32 trillion 594 billion.

I will now go on to number 7. The amount produced, 876 billion cubic feet.

Now, the disposal gas is 20 trillion 355 billion cubic feet. That is column 8.

Column 9: available supplies for Alberta utilities, 8,267; that is, 8 trillion 267 billion cubic feet. The estimated requirement for Alberta utility for use and deliverability, 13 trillion 523 billion cubic feet.

Beyond economic reach, 1 trillion 419 billion cubic feet. Reserves committed to export, that includes Trans-Canada, Montana Power, West-coast Transmission, 7 trillion 945 billion cubic feet. Market available for export, 2 trillion 723 billion cubic feet. And here I wish to pause. It is quite possible when Trans'Canada's market requirements are known that all of that amount will be required for Trans-Canada.

Solution gas: 1 trillion 758 billion

cubic feet.

Associated gas, 3 trillion 160 billion cubic feet.

Non-associated gas, 15 trillion 437 billion cubic feet; and for those who are statistically inclined I might say this all balances; if you care to add them up you will find columns 14, 15 and 16 balance with column 8. You will find, however, columns 18 and 19 do not balance. That is, columns 17, 18 and 19 do not balance because the acid content is included in column No. 5.

Discount for surface loss, and it is necessary to take whatever percentage is taken in the sheets which add to 13 for all the original gas in place in order to get the correct figure in columns 18 and 19.

Now, sweet gas: 9 trillion 138 billion cubic feet, and that is, roughly, half of the gas reserves, disposable gas reserves in the Province of Alberta at the present time.

The low acid gas, 6 trillion 945 billion cubic feet.

High acid gas, 8 trillion 939 billion cubic feet.

Sulphur reserves, 68 billion 397 million tons. I have mentioned that at 100 per cent. recovery, but sulphur plants are, usually, over 90 per cent. -- in the neighbourhood of 93 per cent., but

as they vary I took 100 per cent., and I will qualify it with the figures I have given you. It will be, at least, 90 per cent. and some claim 96 per cent.; it depends on the individual plant.

I now wish to, with your permission, sir, turn to Table B which follows immediately afterwards and which will, more specifically, deal with the Lethbridge - Calgary - Banff area. These are fields directly affecting the consumers in the Calgary-Lethbridge area. They are exactly the same figures under exactly the same headings and carried over into the right hand column; column 20. I wish to draw your attention to the Calgary field under column 1 and down to the Devonian and Crossfield, which is about the middle under column 2.

Carrying that across to the extreme right hand side is a sulphur reserve of 9,610,000 tons. Under column 16, Non-Associated Gas, you get the figure 302. That sulphur has been evaluated by Westcoast Transmission at $20 a ton, and that gives you a value of, roughly speaking, $180 million. Westcoast also quoted a price of 18 cents a thousand for the gas, and at 302 billion that gives you a price of roughly $54 million. In other words, Crossfield is really a producer of sulphur with a by-product production of fuel. Okotoks is a similar type of field: the quantities are smaller, but the proportions are roughly the same. Again, to make sure that the figures are fully understood, the 430 under Okotoks Crossfield -- which is a little further down in the column -- you take 10 per cent off it and you get the 387 under BCF in column 19. It is on that 387 that the 33 per cent is taken to get the quantity of hydrogen sulphide, and, of course, hydrogen sulphide is translated into tons by calculation.

Have I made myself clear, sir?

THE CHAIRMAN: Yes, Mr. Davies.

THE WITNESS: Now, the problem with regard to the City of Calgary is this: we have not asked for any fields in this table that we do not propose to take any gas from. Our idea is to take the gas as fast as the Conservation Board will allow it to

be taken. The Conservation Board is the proper authority to decide how and when and how much gas is to be taken in any day or any year. We have also gone out of our way in this table to provide for this production of sulphur. If we take the gas, of course, it helps in the production of sulphur, but what we do not know is whether that half a million tons a year of sulphur can be sold; secondly, if it can be sold, at what price it can be sold, and should it turn out that it cannot be sold at all or sold at a loss we do not wish the consumers of gas in Southern Alberta to be required to assume any portion of the costs of producing sulphur.

We thought the production of this table would be of some value to the Commission as it gives a very definite and concrete example of the relationship between the market for sulphur and the position of the consumers of gas. That being the case with regard to Southern Alberta, it also applies to the rest of Canada.

I would be very happy, sir, to answer any questions that may be asked.

MR. HELMAN: Before we leave the table and go back to the headings of the letter, Mr. Chairman and gentlemen, I thought that if there were any questions about this table, perhaps this is the appropriate time for them to be asked, if anyone wants to discuss them.

MR. PATTILLO: I prefer, Mr. Chairman, to hear the whole of what Mr. Davies has to say, and then I would endeavour to conduct my examination at that stage, and my friend will have ample opportunity to re-examine and bring anything out.

THE CHAIRMAN: Carry on, Mr. Helman.

MR. HELMAN:

Q. Will you turn back to the letter at the front of this brief, Mr. Davies, about the things that you have concluded, that the consumers of gas in Southern Alberta were to be assured about. The first heading is: "All Reserves of Natural Gas now connected to the present Canadian Western Natural Gas Company System should be kept for consumers of gas on that system." First of all, what are the reserves of natural gas that are now connected to the present Canadian Western Natural Gas System?

A. Jumping Pound, Turner Valley, Bow Island and Foremost. They are shown on the plan before the tables and immediately after this letter. Jumping Pound is straight west of Calgary and a little bit north. Turner Valley is southwest of Calgary. Bow Island is east of Lethbridge. Foremost is south of Bow Island.

I am referring here to Southern Alberta. Canadian Western does have other lines like Brokks that is not connected with this particular system,

and other towns to the north of Calgary that receive their gas from Nevis.

The point about that first point is that there is a contract in existence between Alberta Southern and the Canadian Western under which Canadian Western may return gas to Alberta Southern in exchange for peak load gas drawn from Alberta Southern. They return, however, 1.3 times as much gas as they get, and our present reserves are largely bought many years ago. The average price is in the neighbourhood of 10 3/4 cents, and we don't think that deal makes sense at all, sir.

Q. That is contained in a contract ---

A. Alberta and Southern contract.

Q. With the two gas companies?

A. That is right.

Q. Northwestern Utilities --- -

A. Alberta and Southern being a corporation.

MR. WILSON: Would you mind repeating what you said about the 1.3 again?

THE WITNESS: As I understand the contract, Canadian Western may receive from Alberta and Southern peak load gas and return to Alberta and Southern from its own reserves of gas 1.3 times the quantity of gas received from Alberta and Southern.

MR. WILSON: Thank you.

MR. HELMAN: Q. The point, I take it,

you make in paragraph 1 is that it will exhaust the reserves of natural gas connected to the present system if use is made of that 1.3 factor in the return of gas?

A. That is quite right, and that is lower cost gas than any new supplies we can possibly get due to the competition of export companies.

Q. The next heading is No. 2: "All gas fields adjacent to Calgary, or adjacent to the transmission lines of the Canadian Western Natural Gas Company should be dedicated for the future use of Southern Alberta consumers of gas." Would you just explain that?

A. There is a gas field immediately east of Calgary; six miles. It has three horizons, and if the Commission would turn to Table B, at the back of the brief, the very last page, you will see Calgary is a field of geological age, Cretaceous under Basal Quartz. Carrying it over to column 16 and column 17, there is 21 billion feet given as reserves, and then under Sweet Gas, 21 billion feet, and then ---

MR. PATTILLO: I think you are reading that incorrectly.

THE WITNESS: I am sorry. That figure of 17.2 is under Low Acid, but it has not got any hydrogen sulphide. That is one of the cases in this table where there is carbon dioxide, and one

of two things is necessary: either the heat content is lower, or the carbon dioxide has to be taken out, but, in any event, that gas holds a certain amount of light fractions -- butanes and propane -- and will be treated, in any event. The Basal Quartz, therefore, has a reserve of 16.8 billion cubic feet, and immediately below it is Elkton with 65.6 billion cubic feet.

These are all absolutely reliable figures because the wells have been drilled. It is not probable, or anything. The wells have already been drilled, and it is possible -- and I only use the word "possible" -- with some of the wells three and a half miles apart there may be more. We feel that gas, having practically no transmission charge at all, should be reserved for the citizens of Calgary, and we cannot see that that gas should be exported to the United States.

Q. As I understand it, in the Calgary field there are three horizons?

A. That is right.

Q. The first one is Basal Quartz, of which you have given us the figure, with its low acid content, of 17.2 billion cubic feet; and the next one is what is called the Elkton, of which the figure appears in here, of a low acid content, of 76.5 billion cubic feet, with some other figures beside it. Then, down further in the formation there is another horizon that produces gas called the Crossfield, and

that is a field which has a heavy sulphur content?

A. That is right.

Q. What is the percentage of sulphur in that?

A. 34 per cent.

Q. And it is only the two top ones, then, that you want to reserve for Calgary?

A. I think I covered previously the problem of sulphur. We are willing to help in finding -- if there is no export at all, we are willing to see that that gas does not remain in the ground. On the other hand, if we are required to pay any portion of the cost, I do not think that gas is economically desirable for the citizens of Calgary.

Q. That is from the Crossfield member only?

A. That is correct; but on the other two horizons it is a different story. They are most suitable because eventually we have to have a treating plant at or near Calgary, in any event, to take gas from north of Calgary in the future years.

Q. When you say a treating plant, you do not mean the type of plant that is used for extracting sulphur in large quantities?

A. I mean a plant that operates at low pressure.

Perhaps I can make myself a little more clear, make the situation a little clearer by describing a treating plant. If it operates at high pressure, say 1,000 pounds, the valves, fittings,

everything else,have to be on a working pressure of such that it will operate efficiently, and great care has to be taken with hydrogen sulphide because it is a deadly gas, a toxic gas, and a leak is fatal to any workmen around it, and extreme precautions have to be taken around high pressure sulphur.

Where the content of the hydrogen sulphide is low, the market at Calgary does not require over 200 pounds; that is sufficient to push the gas through the distribution mains in Calgary, and there is all the difference in the world in calculating the cost at 200 pounds rather than operating at 1,000 pounds.

There is one other factor, that at 1,000 pounds the trays and towers are much smaller because the gas is compressed; but, in any event, the cost lies in the thickness and quality of the steel. Corrosion at 1,000 pounds is very much higher than at 200.

The other point is that while the quantity at 200 pounds is greater in volume, if I can make myself a little clearer, at 200 pounds gas will occupy this room, we will say, but at 1,000 pounds we can compress it down to the size of this table. That is not exact, but it gives you an idea. Now, if we are putting it through a container the size of this table, that is one thing; but if it has to be 2 inches thick, the cost is accordingly.

Now, the other factor with regard to operating plants of this nature is that acid gases are taken out in fluid. It is a chemical reaction and 1 million cubic feet of 34 per cent. hydrogen sulphide requires approximately the same amount of treating fluid as 34 million feet of one per cent. hydrogen sulphide and, therefore, we are interested, as consumers of gas, in the 34 million; we are not particularly interested in the one million.

Q. What I was trying to get at, Mr. Davies, as I understand it, and you will correct me if I am wrong: the cost of a high pressure sulphur extraction plant is much higher than a low pressure scrubbing?

A. That is correct. The other factor is equally interesting to the consumers, that a high content sulphur plant can operate at near 100 per cent. load factor every day of the year, while a plant treating one per cent. hydrgoen sulphide, such as the Madison plant in Turner Valley, can operate at a low factor. It may turn out 95 million feet in the coldest day in winter and 35 million feet on the warmest day of summer, and that is a most important factor from the point of view of the consumers of gas, not only in Calgary and the Lethbridge system but throughout Canada, and we will come to that point again and again.

Q. Now, we were dealing with paragraph

2, about the gasfields adjacent to Calgary or adjacent to the transmission lines of the Canadian Western Natural Gas and, if those fields -- first of all, if those fields are dedicated for the use of the Southern Alberta consumer, will the gas be taken as rapidly as can be produced?

A. Yes.

Q. So the suggestion that we are trying to keep gas in the ground for Calgary's use is not a tenable one?

A. No, there is no basis for such.

Q. And the other point I wanted to make about the dedication of these fields in the neighbourhood of Calgary is that if the gas is taken by the exporting companies and Calgary is only provided with gas when they ask for it, the result will be that the adjacent fields will be rapidly exhausted. Is that right?

A. That is correct.

Q. And then the gas will have to be brought from more distant places?

A. That is correct.

Q. What will that do towards the problem of the cost of gas?

A. It puts the gas, puts the cost of gas up, to us. In most cases they propose to take these permits out in a 20-year period and some are 25. We have asked for reserves for 30 years and,

therefore, if it is taken out before then, the last 10 years we have most expensive gas because you have got to go a long way for it and the cost of drilling in the foothills is very, very expensive.

Q. Could you give us an estimate of costs?

A. Some of the original wells cost as high as a million and a half dollars. Some wells were drilled, oh, six years ago, that cost in the neighbourhood of $800,000. At the present time the development program in the foothills, a well can cost anywhere from a half a million to $800,000.

Q. And that will also make the gas more expensive when those fields are developed?

A. That's right. And there is a point we might as well have now, and that is a question that if that well produced a high amount of sulphur and the sulphur cannot be sold, the whole of that cost must be recovered from the sale of natural gas, so that the whole sulphur problem becomes of very, very great importance.

Q. The next heading you have is the pipe lines, treating plants and other physical assets now used to supply gas to Canadian Western consumers, that they should be used to the fullest possible extent for as long a period of time as the economics of the situation warrant.

Will you tell us what that heading means?

A. If you turn to the map immediately after this letter, there is a field by the name of Sarcee, half-way between Jumping Pound and Turner Valley, south southwest from Calgary. That field has one well, but a very excellent well.

Turner Valley has a treating plant for the removal of sulphur and the Turner Valley treating plant is a public utility. The arrangement with regard to costs is that the 10 3/4¢ is paid by the Canadian Western Company to Madison, no matter how much gas or how many horizons go through that plant. The Madison Company get all their costs in maintenance whether one billion goes through or 17 billion cubic feet goes through.

Now, it is my opinion that there is no necessity for building another treating plant to treat the Sarcee gas, which has about the same quantity of hydrogen sulphide as Turner Valley, and that a gathering line which costs considerably under three-quarters of a million dollars can be built from Sarcee to the Madison plant and put through the Madison plant and does not cost the consumers any more except the return on capital on the gathering line. Therefore, the Madison plant would be used for many years in the future and it is a plant which will produce 95 million feet a day on the coldest day of winter and has operated for many,

many years on a low load factor.

The same thing will be true with regard to Jumping Pound, which is privately owned by the Shell Oil Company, but the day is coming, within six, seven, eight years, when the Jumping Pound will not be able to supply sufficient gas to keep that plant operating at its maximum capacity in the wintertime, and there is no reason why a gathering line cannot be run from the northern end of the Sarcee structure to Jumping Pound. Sarcee, in this case, is being used as an example; but we are discovering new gasfields and we have every hope that new gasfields will be found and, should one be found, say, 25 miles west of the Turner Valley, there is no reason why gas should not be brought from the field to Turner Valley and treated there.

Q. How far is Sarcee, the well which is there now, from Calgary?

A. It is about 20 miles from Calgary.

Q. On the material that has been filed, I understand that the Alberta & Southern Company have a contract for this Sarcee gas?

A. That is correct.

Q. Therefore, if an export permit is allowed to Alberta Southern, this Sarcee gas, instead of going as you have mentioned -- that is, that it should go to the treating plant of the Madison Company -- will be used for export purposes?

A. That is right. It is proposed to take it to San Francisco. We don't see that at all, sir.

MR. PATTILLO: You mean you do not see the gas or you do not approve of it going to San Francisco?

MR. HELMAN: We think it should be used here, Mr. Pattillo.

THE WITNESS: If you ask that question in two parts, sir, I will give you an answer.

MR. PATTILLO: You used the expression that you did not see it at all, and I thought it was an ambiguous expression.

Q. Under heading 3 is there anything that you want to comment about the storage facilities that Canadian Western now has?

A. The storage fields east of Lethbridge have been used since 1931. At Bow Island they have been very successful, and the town of Lethbridge is likely to have quite a rapid growth in the future and it is highly desirable that Foremost, south of Bow Island, be repressured and also used as a storage field. I understand that is already contemplated by the Canadian Western Company, but it is another example of using the investment in storage fields and pipe lines for as long a period as possible.

Q. The next heading, No. 4, I think you have already dealt with in discussing other headings here about the production of sulphur and other products, and there is nothing you want to add to that?

A. No, sir.

THE CHAIRMAN: Mr. Helman, do you think this might be a good place at which to have a ten-minute break, and give Mr. Davies an opportunity -- I do not want to interrupt the trend of your thought.

MR. HELMAN: No. We have still quite a lot to cover, sir, so this is as good a place as any.

THE CHAIRMAN: Very well. We will adjourn for ten minutes.

---A short recess.

THE CHAIRMAN: May we proceed, Mr. Helman?

MR. HELMAN: Thank you, sir.

Q. Mr. Davies, when you were dealing with the problems of the low load factor, this low load factor not only applies to Calgary and Lethbridge but it also applies to Winnipeg and all of Eastern Canada?

A. Yes, sir.

Q. I do not know whether it has been explained to the tribunal what a load factor is and how it is arrived at, and what it means exactly -- perhaps the Conservation Board has explained that?

THE CHAIRMAN: Yes, I think they have explained that.

MR. HELMAN: Q. They have covered it. What is the load factor, for instance, that the Canadian Western Natural Gas Company has been operating on until the present time?

A. Around 42 per cent, sir.

Q. And what is the figure for Northern Utilities at Edmonton?

A. I believe 43 per cent.

Q. I did not hear you.

A. I believe 43 per cent.

Q. And I believe in places like Winnipeg where they have even more severe winters than we have here we would have a load factor that is even less favourable?

A. That is correct, and domestic consumers generally have a load factor of around 35 per cent.

THE CHAIRMAN: What you mean by that is after the exclusion of the industrial consumer?

THE WITNESS: That is right, sir, and the reason why Canadian Western has an average of 42 per cent is because some large industrial consumers have load factors of over 90 per cent.

MR. HELMAN: Q. Now, you have already pointed out to us about this 1.3 factor that I think Alberta and Southern is going to charge for peak load gas under their contract

A. Yes, sir.

Q. Can you see any reason why this extra 30 per cent should be charged to the local consumers?

A. No, sir.

Q. Have the export companies storage facilities in the United States which could take up the load?

A. Yes, sir, their brief so states.

Q. So that they could fill these storage fields, and when Calgary required peak load requirements they could still supply Calgary and at the same time supply their United States customers from their storage fields?

A. Yes, sir. It is a question of their taking gas from Alberta, if granted a permit,

during the summer months to the maximum capacity of the line and taking less gas during the winter months when Canadian consumers require the gas, and so the peak load problem of Canadian consumers will be solved in that manner if export is granted.

Q. And, therefore, this 1.3 penalty factor, in your view, I take it from what you have said, is not justified?

A. I cannot see it, no, sir.

Q. Now, let us turn to heading No. 5 that you have here: "The sweet gas reserves of the Province of Alberta are limited. They should in general be reserved for Canadian consumption." Can you give us any further explanation of that?

A. Well, sweet gas reserves may be produced in a large amount in the winter time and in a small amount in the summer time, and as that is the way our consumers in Canada consume the gas we have no penalty problem if the gas is produced in accordance with market demands.

Q. Well, in a word, in the sweet gas field the gas does not have to be produced at any particular load factor?

A. No. The Oil and Gas Conservation Board could make the rules governing the rate at which wells are allowed to produce, and it is my opinion that these matters should not be set by contract but should be set by the Oil and Gas Conservation

Board in accordance with good conservation practices.

Q. The next heading we have here, Mr. Davies, is heading No. 6: "The reserves of low acid and low hydrogen sulphide gas are likely to be more abundant than those of sweet gas. These reserves should also be reserved for Canadian consumption." Would you explain that?

A. There are two parts to that question. On the map immediately following this letter the area from the 5th meridian, which runs just east of Calgary -- and the 5th meridian is marked just south of Calgary, about ten townships south of Calgary. You will see the 1st meridian marked. Now, the area west of the 1st meridian to the foothills ---

THE CHAIRMAN: The 1st meridian or the 5th meridian?

THE WITNESS: I am sorry; the 5th meridian. --- contains Mississippian and Devonian rocks, but the Mississippian rocks are within drilling depth at the present time. They vary from -- well, Turner Valley is one of the shallowest; it is 5500 feet to the uppermost Mississippian rocks, and when you get further west, in the southwest corner of the Province, wells are some 12,000 feet deep, and they produce from Mississippian rocks. Now, it is highly likely other fields -- large fields -- will be found in the area west of the 5th meridian towards the foothills, and outer range of the Rockies. A recent discovery

is on the map at 384, almost straight west of Pembina.

Now, we are dealing with a very vast stretch of country, but these rocks so far have all contained sulphur in the Mississippian, and some of them a very high content -- 31 per cent. A 12,000-foot well at, we will say, Castle River or W.terton or Pincher Creek, if there is no sale for the sulphur, or a very low price for the sulphur, is not a suitable supply for gas consumers in the southern part of Alberta on account of its price, but a low content sulphur such as Sarcee, Jumping Pound and Turner Valley is a different proposition altogether because the bulk of the production from the formation is methane and not sulphur and carbon dioxide and, therefore, we ask that those reserves of low acid and low sulphur be reserved not only for Calgary but for Canadian consumption generally because a low load factor market is a characteristic of the whole of the Canadian market due to our climatic conditions. We cannot change our climate.

MR. HELMAN: Q. Yes. Well, I think that is said in reverse in paragraph 7: "Export of natural gas to the United States should be based on gas from high acid gas reserves. The problem of finding a market for the very large production of sulphur from these reserves should be considered before any permit is granted." I think you have already dealt with that in passing with the other

points we have been dealing with?

A. Yes, sir.

Q. The next heading is No. 8: "Present proven reserves of natural gas adjacent to Calgary should not be included in any export permit. Exhaustion of these reserves means that more new reserves must be found a greater distance from Calgary with corresponding higher cost to consumers of gas in Calgary and Southern Alberta." I think you have already touched on that, have you not?

A. Yes, sir.

Q. "9. The price of gas to Canadian consumers and specifically to Southern Alberta consumers, should not be higher than cost of production and a fair return on capital warrant. Export corporations are competing with each other for supplies of gas for export to the United States." Would you like to explain that any further?

A. The Canadian consumers -- that is, the Southern Alberta consumers -- do not object to paying the cost of production. We do not object to paying a fair return on capital invested. We do object to being put in the position where we are competing with export companies for supplies of gas, or where we have to pay the prices that export companies have arranged with producers for export gas. We, in Alberta, cannot hope to compete with consumers in California, and for this reason, sir, that the

average amount of gas used in California varies from the northern part to the southern part of the State and I am going to assume a figure of 100,000 cubic feet per year as against 215,000 cubic feet used by each customer per year in Southern Alberta -- and an increase of 15 cents a thousand cubic feet to a consumer in California on the average means an increase of $15 a year. That same 15 cents per MCF means an increase to the Southern Alberta consumer of $32.50. Now, an increase of 15 cents will serve to bring gas through a 36-inch diameter line a very long distance. Under 2 cents per thousand cubic feet will serve to transport gas a hundred miles.

Q. Will you continue, Mr. Davies?

A. If you took 2¢ you could bring the gas some 750 miles for 15¢. The $32.50 we figure comes out of somebody's pay cheque and it is those pay cheques the City of Calgary is interested in. There are an equal number of pay cheques in Southern California and it only costs them $15 and it costs us $32.50.

We come to a point where they could take all our gas, or would be glad to take vast quantities of it and we would be in a position where we would be priced out of our own market. We, therefore, feel that Canadian consumers, generally, and specifically the consumers we are representing here today, require protection in some form, and the only protection we know of, Federally, is through the permit that is granted across the international border.

Q. Mr. Davies, can you give us any illustration as to how the prices have increased due to export; that is Trans-Canada and the Canadian Western paying for gas at the present time?

A. Canadian Western prices, set in 1949, 10 3/4¢ at the treating plant in Turner Valley. I have not seen any contracts but I understand Trans-Canada's price is 12¢, MCF at the outlet, the treating plant. We were offered in East Calgary, at the outlet of the treating plant, gas at 18¢ by Westcoast transmission.

Q. And that is subject, as I remember the contract, to a sliding scale?

A. It continues to go up at a very high load factor and a very high load factor is very difficult, for something like 35 per cent. of the domestic market to utilize.

Q. And that is gas that is right adjacent to the City of Calgary?

A. That is correct, sir. I want to make that point about the 35 per cent. of the market absorbing the peak load price. A customer that uses gas at a steady rate throughout the year at a high load factor is entitled to and gets a lower rate per mcf throughout the year. The individual who causes the low load factor is, primarily, the space heating customer and space heating customers are largely domestic customers. They are the consumer who requires gas when it is 40 degrees below zero. The demand then is very high. They are the people, therefore, who should and must pay peak load costs. When the rates are being considered, new investment is being considered, it is entirely a matter of peak load. It is, therefore, not distributed amongst all consumers; the large industrial consumer pays a very small part; the bulk of it goes against those who use gas at a 35 per cent. load factor.

Have I made it clear, sir?

Q. That is, domestic consumers?

A. That is, largely, the domestic consumer.

Q. As I understand it, Alberta & Southern suggest its prices are somewhat lower than Westcoast's. What have you to say about that?

A. I did not find it so in examining the contracts. For example, the reason Alberta & Southern have not yet built lines and they are unlikely to build lines until, perhaps, the year 1961, and the sliding scale would be the price in the year 1961 or 1962, and that is when we would have to consider it for comparison.

Q. Do you remember that price? I have a note here it is 15 3/4¢.

A. 15 3/4¢ to which must be added transportation costs, and I endeavoured to find out what the transportation costs would be, and at the moment it is 4¢ a thousand, but that figure is not definite and it may in the future be changed. I would think if it changed, it should be less than 4¢, but I have no guarantee that that will be the case.

Q. And that 15 3/4¢, apart altogether from these transportation charges, goes on a sliding scale?

A. That is right, sir.

Q. What is the sliding scale, do you remember?

A. No, sir, I do not.

Q. Would it go up every six months, yearly?

A. It goes up annually and, I believe, 1/3 of a cent a year, but I do not remember the details.

Q. We will get that when Alberta Southern put in their submission. Let us now go to the tenth heading we have here. "In explanation of the points enumerated the market for natural gas in Canada is a large one. Domestic consumers in Calgary each use 215 thousand cubic feet a year on the average. This is much higher than the amount used per year per domestic consumer in California. The problem, however, is that the Canadian consumer uses the gas in large volume in the five cold winter months. Pipe lines, distribution lines, treating plants, and the volume of gas produced by wells must be large enough to satisfy the demands of the consumers on the coldest day in winter. Storage fields, and interruptible consumers help to modify the demand; but it remains a large factor in the natural gas business in Canada."

Will you explain that statement in the letter there?

A. Contracts have been signed between producers of gas and one particular contract which I examined was between Alberta & Southern Gas

Company and Imperial Oil Limited which was not on any particular field but which was on the area from the international border to township 57. I am not just certain whether it is the bottom of township 57 or the top of 57, but it is in the contract, and from the 5th meridian to the west boundary of the Province. Now, that is a very vast stretch of country and, as I read the contract, I see that all the gas Imperial Oil might discover in exploration goes to Alberta & Southern. Now, when you add to that -- by the way, there are many more contracts; there are a whole sheaf of contracts which are out of my field to examine in detail.

THE CHAIRMAN: Mr. Davies, I do not like to interrupt you at this time, but would you mind telling us where township 57 is located?

A. On the little map on the right hand side (indicating). It is north of Edmonton. Do you see the number 57 on the right hand side, sir?

MR. HELMAN: We will have to get a magnifying glass for this map, Mr. Chairman.

A. Township 1 is at the international border and 57 is on the right hand side, and you carry that section across the Province.

THE CHAIRMAN: Thank you very much.

A. When you take the 5th meridian and run it straight north it intersects township 57, and when you take all west of that it is a very

broad stretch of country and a most likely area of the Province for the discovery of new gas reserves. When you add to that the location of a 36-inch diameter pipe line, which is also shown by a dotted line on the map following this letter, by its very location, the permit to put it there, would automatically rule out somebody else going in and putting another pipe line there, and if that pipe line is dedicated to take 8 million cubic feet out of the Province to San Francisco and you put the contracts together and you put the pipe line together then, in my judgment, you make it very difficult for anybody else to enter that territory which, in effect, creates a monopoly which, from the point of view of the consumers in Southern Alberta, is undesirable.

Q. Mr. Davies, can you give us any rough estimate -- I know you have not actually worked it out, because I have asked you about this -- as to the amount of sulphur which will be produced per year if both export permits are granted?

A. If we turn to page 14 on Table A, that is the second last page, we have a total sulphur reserve of 68 million tons under column 20, and I figured it out, roughly, last night and it amounts to, in the Calgary area alone, a half a million tons a year. I have already covered that point previously and, in the Province, if all these permits were

granted, plus the production from Pincher Creek, Fort St. John, Turner Valley, Okotoks, Calgary adjoining the Wimborne field, amounts to a production of over 2 million tons a year.

Q. I think we have covered everything in that submission, and I just want to turn for a moment to Exhibit C-7-1-A, the document that is filed with the Conservation Board. This contains a great deal of technical matter and data which I do not want to go through with you, but I would like to have you read the letter of January 9 which appears almost at the very front of this document.

A. I am reading, sir, from Exhibit C-7-1-A:

"Four technical reports have been prepared
"and are attached. The reports deal with
"various phases of the matter of the
"price and supply of natural gas to Cal-
"gary consumers, and other consumers on
"the Canadian Western natural gas system
"from Calgary to Lethbridge, Lethbridge
"to Taber, and Lethbridge to Cardston."

Mr. Martin will be appearing before you this afternoon.

"Mr. Martin, in his report, has shown
"a marked increase in population over
"the figures used by the Canadian Wes-
"tern Company, Exhibit 24."

Q. Now, let us stop there: Exhibit 24 is an exhibit filed before the Conservation Board?

A. That is right, and it is, I believe, included in an exhibit which will be filed by Canadian Western subsequently.

Q. At this hearing?

A. Yes.

Q. But it won't necessarily be Exhibit 4?

A. I didn't have time to examine it in detail.

Q. I see.

A. "The annual increase in consumption
"is 2.6 billion cubic feet in 1960,
"and has been continued at that
"same amount each year for 30 years.
"This means in a sense that
"the more people in a metropolitan
"area, the lower the annual incre-
"ment of population, and the lower
"the rate of industrial growth.
"This assumption is not a sound one,
"and is in fact likely to be proven
"incorrect. The larger the popu-
"lation, the greater the growth of
"industrial consumption of fuel, is
"a sounder conclusion."

Mr.Martin will deal with this point this afternoon.

"Time did not permit a re-calculation

"of the Canadian Western requirements
"based upon Mr. Martin's data. Mr.
"Martin and myself completed our
"respective reports at the same time.
"I believe that the requirement data
"shown in Exhibit 24 is too low by
"a substantial amount."

Mr. Chairman, I have made many estimates of reserves required for the future and I have considered that I was doing the very best I knew how, and I have always been higher than Canadian Western, and I have always been wrong by being too low.

"Mr. Workman and Dr. Flock . . . "

-- these are the two witnesses which Mr. Helman mentioned previously, and we hope to be able to call them to give some evidence as to exactly how reserves are estimated, so that the Commission will have some idea of the accuracy or otherwise of the many reserve estimates submitted to them --

"Mr. Workman and Dr. Flock have
"examined the Calgary Field in detail;
"and their evidence will show that the
"marketable natural gas reserve is
"about half that estimated by the
"Westcoast Transmission Company. Even
"this estimate will depend upon the
"cost of wells, cost of producing them,
"and the revenue to be derived from

"them. Sulphur is the largest single "product. It is quite possible that "the production per well will be too "small in the year 1980 to warrant "further drilling."

Mr. Chairman, the situation in the province is this, that we are dealing with an early phase of a development of our resources. We have few actual examples of fields in old age, and there is a definite economic factor enters into how you recover the gas in the latter stages of production from a large number of depleted fields. Many have estimated that the amount of gas to be left in the ground is, as the report the Conservation Board put in and the report I put in indicates, say, 10 per cent. We may find that figure is far too low, and that in many cases our reserves in this province have been over-estimated due to the economic factor and not being able to get out, at a reasonable cost, the tail end, if you like, of the reserves in a number of fields. Where there is unknown data we have no experience to go on and it is, therefore, an open question, and, being an open question, I draw it to your attention, sir. That is the point in the last sentence in the paragraph I have just read.

"A plan for the future supplies "of gas to Calgary has been put for- "ward by the Canadian Western Natural

"Gas Company Limited. It included the "purchase of gas rights at Carbon . . ."

Carbon is shown on that little map, 50 miles north-east of Calgary: dry gas, the amount of reserves still in question.

"It included the purchase of gas rights "at Carbon, the reserve of which was "estimated by Canadian Western at "206 billion cubic feet. A price for "proven land was set at $300 per acre, "and for probable acreage at $300 an "acre."

Mr. Chairman, this question of "proven" and "probable is a method by which geologists guess at what is likely to be in the ground. It is very hard to say where "proven" ends and "probable" begins, and sometimes the "probable" is very much an imaginative figure.

"Any acreage could be changed "from probable to proven by the drill-"ing of one well per section of land. "The cost of drilling a well at Carbon, "completed for production, is approxi-"mately $80,000. The total acreage "involved is by Canadian Western esti-"mate 19,000 acres, or 30 sections. "The option with Shell Oil Company "covers 5,168.2 proven and non-proven "acres. Any other contracts held by

"Canadian Western covering acreage
"in this area have not been produced
"to this date."

The purpose in reading this letter, Mr. Chairman, is to give you a concrete example of the problems faced by consumers in Southern Alberta due to the fact that we have export lines entering our territory.

"It has been proposed that Carbon
"would be used to supply peak load, and
"a 16-inch OD pipe line to Calgary
"would be built at a cost of $2,700,000.
"Another pipe line, 20 miles long,
"would have to be built from Calgary
"to a point on the Sarcee Reserve, to
"connect with the Alberta Trunk Line.
"This line might have to be a 20-inch
"outside diameter line, and its cost
"will have to be considered.

"The general idea behind the
"proposed Canadian Western plan was
"that gas would be purchased from
"Alberta and Southern . . ."

-- that is,the export company --

". . . on a 70 per cent load factor
"basis, and the consumers of gas in
"Southern Alberta would pay all the
"cost of making this possible."

In other words, we go out to Carbon, we spend what

is now estimated in 1958 and 1959 $9½ million; we use very little of the gas except on the very cold days. By spending that amount of money -- and I estimate it will cost the domestic consumers in the neighbourhood of 8 cents a thousand -- we then put Canadian Western in a position whereby they can buy a larger quantity from Alberta and Southern at a 70 per cent load factor.

"The alternative offered is "that Canadian Western would buy gas "from Alberta and Southern at a "price 1.3 times the weighted "average field purchase price "paid by Alberta and Southern".

And, as remarked some moments ago, the cost of transportation of that gas would be added to whatever that figure was.

"My objection to the proposed "Canadian Western plan is based upon the "fact that space-heating consumers on "the Canadian Western System are penalized because they use more gas in "winter than in summer. The Calgary "System has a low load factor, of around "35 per cent for space heating, and just "over 40 per cent when industrial consumers

"are included because of cold winter "days. Load factor is defined as the "average consumption per year divided "by the consumption on the coldest day "of the year.

"It is my opinion that there should "not be any penalty to the Canadian consumer "for load factor in any contract between "an American export company and an Alberta "producer. The gas reserve is located "in Canada, and not in the United States, "and no consumer in Canada should have "to pay more in any gas field for gas "than any other consumer. An example "is the Sarcee field, now under contract "to Alberta and Southern Gas Company "Limited. At a load factor of 70 per "cent the price is the weighted average "field price paid by Alberta and Southern; "but Canadian consumers need this gas at "a lower load factor than 70 per cent. "The price to be paid to Alberta and "Southern would then be 1.3 times the "weighted average field price paid by "Alberta and Southern. The consumers "in Southern Alberta should not be the "victims of any such discrimination, "especially so in this case, as the

"gathering and treating of the Sarcee "gas,as shown in my report, could be "handled in the most efficient manner "by the existing Madison Natural Gas "Company plant at Turner Valley, and be- "come part of the Turner Valley system.

"Calgary consumers have been "paying for large gathering lines, treating "plants, and for wells for 40 years; and "they can continue to do so, without any "large and unnecessary expenditure in "the years 1958 and 1959, relating to "the Carbon field development."

I have shown on the deliverability table that, according to me, Carbon is not an essential factor for the Canadian Western System if interruptable customers are used. They already have one interruptable customer on the system and, rather than increase the price some 8 cents to the domestic consumers, I am quite certain that the domestic consumers would approve very highly of an introduction of an interruptable rate for some of the large space-heating consumers during the winter months. That, in effect, means that they get a special rate because they can be cut off during the cold periods in the winter.

I.

"The Calgary consumers should not have
"to depend upon any export pipeline for
"gas; but should have clearly defined
"gas reserves dedicated solely for the
"use of Southern Alberta consumers."

We attach great importance to that point. We do not think the two should be mixed whatsoever. There are too many unknown factors, too many factors that can be used to the detriment of the consumer, and we do not think the two should be mixed at all.

"These reserves should include the Fore-
"most, Bow Island, Okotoks, Calgary,
"Jumping Pound, Sarcee, Turner Valley
"and Sundre-Westward Ho-Harmattan and
"Crossfield fields.

"The reserve of 1220 BCF in the
"Sundre-Westward Ho-Harmattan-Crossfield
"area is classified at present as assoc-
"iated with crude oil production, and
"may not all be available until 1982.
"Because of this factor there may be
"some merit in the idea of building a
"smaller diameter line than 16-inch
"to Carbon to buy gas at so much MCF.
"However, the length of the line for
"such a small reserve as 206 BCF will
"make it very expensive gas. In any
"event it would not be required until

"1963."

There is an alternative to that, of course, and that is to add more fields than the 206 BCF from a sweet gas area and then the 16-inch line might be a reasonable expenditure.

"It is my opinion that no corporation "should have the right to set by con- "tract any load factor in a gas purchase "contract. Any such condition should "be set by the Oil and Gas Conserva- "tion Board. If Canadian Western wishes "to purchase from Carbon at a 10 per "cent. load factor, that should be set- "tled by the Board and not by any contract."

It is a very important point, sir, for this reason: There are others who contend that if you want to take gas from any sweet gas fields at a 10 per cent. load factor, you have to buy the gas in the ground. I believe that to be an untenable position entirely. Whether you take it at 10 per cent. load factor or whether you take it at a 90 per cent. load factor is a matter for the Conservation Board. What the producer is interested in is the annual amount of sales per year and any sweet gasfield, if he gets sufficient money to pay him a good return and enough money at the wells or what we term a reasonable payoff basis, he has no particular kick, and the 70 per cent. is not a matter that should be

contracted between the purchaser and producer of the gas but should be set by the Conservation Board.

"The total gas reserves available, in-
"cluding all the gasfields near to
"treating plants at Jumping Pound and
"Turner Valley, or to the transmission
"lines of the Canadian Western Company,
"including Carbon, amount to 3231.7
"BCF. This includes 1220 BCF, which
"may not all be available until late
"in the 1980's. The estimated needs
"of the Canadian Western system amount
"to a minimum of 2273.6 BCF."

Now, I find that that figure should have the Banff figure added to it. Banff is a town west of Calgary -- you have all heard of it -- but it is entirely dependent upon Jumping Pound for its supplies, while Calgary and Lethbridge get their supplies at the storage fields at Bow Island and Foremost and from Turner Valley and Jumping Pound and in future, perhaps, from several other fields; but Banff is entirely dependent on Jumping Pound and, in that reference to 2273.6 BCF, I was referring to the balance of the Canadian Western system, not including Banff. When Banff is added, that new figure comes out to exactly the same figure that has been used in the submission, Exhibit C-7-1 which was

placed before you this morning.

"The daily peak load, which is so impor-
"tant a matter to all consumers of gas
"on a -40° Fahrenheit morning, will
"amount to over 700 million cubic feet
"in 1987, and even in the year 1968 the
"peak day would require 400 million
"cubic feet. To supply a peak day of
"700 million cubic feet will require
"substantial gas reserves, the whole
"capacity of which will be needed for
"winter months. The annual quantities
"sold will amount to over 115 BCF by
"1987. The overall load factor of this
"market in 1987 will be 42 per cent."

That is the figure which I mentioned previously.

"It is estimated that to supply a peak
"load of this magnitude will require
"gas reserves of 4220 BCF. The Deliver-
"ability Table given in my report shows
"that 843 BCF will be used from Sundre-
"Westward Ho-Harmattan or Crossfield by
"1987."

I should pause and say that if the Conservation Board still retains those reserves as associated gas, that amount of gas has to come from some place else. Therefore, if you are going to go to Crossfield or to Carbon for gas, you need a lot more

than 206 billion cubic feet, if it is going to be an alternative to supply what we require in our next 30-year period.

The other alternative is that you buy it from Alberta & Southern, but I am going to assume here that Alberta & Southern does not get a permit and we will have to look for gas, and have to look for a substantial amount of gas, in the next 30 years.

"If the Board should decide that this gas--" that is, the associated gas and so on --

"-- cannot be released until the oil
"has all been purchased, then additional
"non-associated, low acid content gas
"will be needed by Southern Alberta
"consumers by 1963."

Perhaps the Commission will now see why we are referring in such pointed terms to the question of the market for sulphur. We cannot depend upon getting our supplies from high acid fields or high sulphur fields because of the cost factors and, therefore, must look to either sweet gas supplies or low acid gas supplies for our own reserves for the next 30-year period.

"The trend of growth, and the rate of
"discovery of reserves may provide
"sufficient marketable gas in the next
"5 years to replace the Sundre-Westward

"Ho-Harmattan-Crossfield associated gas "reserve."

But we have no guarantee of that.

"The plan proposed in my report is de- "signed to provide Southern Alberta con- "sumers with an adequate supply of gas; "and without any large and unnecessary "increase in cost to them for some years."

Q. Now, Mr. Davies, I am not going to attempt to go through the other parts of this submission, but they are the technical data on which that letter was based?

A. That is correct, sir.

Q. Mr. Bredin brings to my attention that what the Board would perhaps be interested in is the results -- the East Calgary field that are in here.

A. The East Calgary field has had an additional well drilled since -- by the way, that is in part ---

Q. It is under Professor Flock's submission ---

A. "Report of Gas Reserves and Deliverability."

THE CHAIRMAN: Part C?

THE WITNESS: Park B, and it is dealing with the Calgary field. An additional well has been drilled, including the Basal Quartz, the Elkton

and the Crossfield.

I might give you some figures of costs on these wells. A well completed to the Crossfield, which is some 8500 feet, costs, completed, for production, some $265,000. To the Elkton and Basal Quartz, which is 1200 feet shallower to the Elkton and 1300 feet shallower to the Basal Quartz, the cost is approximately $200,000.

The reason that it costs so much to the Crossfield is that, in some cases, special tubing is required and they have to have heating equipment in order to produce this very, very toxic gas, because of what we call a freeze-off; that is, hydrates form with the sulphur.

Now, another well has been drilled to the Elkton and, in the reserves given us by Dr. Flock, I have his permission to say that he would double the quantity of reserves from the Elkton. That is given on Table 2, the Calgary field, Elkton, and he now makes his reserve, instead of 32.85, a reserve of 65.7.

The Basal Quartz, turning back one page, Table I, he does not wish to increase that at all. There was some Basal Quartz production, 1 million feet a day; but it is not definite enough, at the moment, to increase the reserves.

Q. Coming, for a moment, Mr. Davies, to the Crossfield reservoir, that is the deepest one,

how does Dr. Flock's figure on reserve compare with those that Westcoast has already provided?

A. The Westcoast is 625 billion cubic feet. Dr. Flock's is 302 billion feet and I notice, in the Board's report, 325 billion feet.

Q. It is almost half of the Westcoast figures?

A. That is correct.

THE CHAIRMAN: Mr. Helman, if you would find it convenient, we will adjourn now for lunch and reassemble at 2.00 o'clock.

MR. HELMAN: Yes, that would be very helpful, unless Mr. Pattillo has some questions he wants to ask at this stage.

MR. PATTILLO: Well, as I understand it, you have now concluded your examination of Mr. Davies?

MR. HELMAN: Yes.

MR. PATTILLO: And I will take up the cross-examination.

MR. HELMAN: After lunch?

MR. PATTILLO: After lunch.

THE CHAIRMAN: Thank you.

---Whereupon the hearing adjourned at 12.15 P.M., until 2.00 P.M.

---Upon resuming at 2.00 p.m.

THE CHAIRMAN: The Commission will now resume its hearing. Mr. Pattillo?

MR. PATTILLO: Thank you, Mr. Chairman.

Q. Mr. Davies, I would like to try, if I can, to get first the general propositions that you are putting forward this morning. Am I correct in thinking that the first one that you were putting forward was that on the basis of the present known reserves there was not, in your opinion any gas available to export outside of Canada?

A. That is substantially correct. To give you an exact answer I would need to know the requirements of Trans-Canada Pipe Lines over and above their present permit.

Q. That is right, but as I understood it you thought, and having regard to the figures that you came up with, there was only an excess of 2 trillion---

A. That is correct, sir.

Q. And it was to be remembered that Trans-Canada was going to need that either presently or in the near future?

A. That is correct, sir.

Q. Now, am I correct in thinking that the second proposition you were putting up was that the consumer in Calgary was entitled to have set aside for his benefit certain fields?

A. Correct, sir.

Q. And am I correct in thinking that you make that proposition regardless of whether or not there is gas for export to the United States?

A. Correct, sir.

Q. And then do I understand you to say that in the alternative if gas is to be exported to the United States it should be done so that no penalty falls upon the people of Calgary?

A. That is right, sir.

Q. And, finally, your last proposition, as I understood it, was if they were going to permit export it should not be done in a manner which gave any company a monopoly?

A. Yes, sir.

Q. Well, now, may I deal with these various propositions in this way: Let us take the proposition of the setting aside certain pools for the people of Calgary regardless of whether or not gas was to be exported. That is the proposition I am going to deal with now. Do you know of anywhere on this continent where any governing body has done just that?

A. Yes, sir.

Q. Where?

A. That is the general practice, sir, in the State of Montana, which is quite close to us. The fields serve certain pipe lines, and only those

pipe lines.

Q. Is that not a different proposition entirely? I assume that the way the gas business is operated on this continent is that when you have a pipe line going into a field you do not have more than one pipe line from that field?

A. We very often do.

Q. You very often do, you say?

A. Yes, sir. The Panhandle is an example there. There are a great many pipe lines in the Panhandle of Texas and Wyoming.

Q. Are you also talking about Montana and Oklahoma? Are you saying there would be more than one pipe line coming out of one field?

A. The Panhandle -- I am referring to a specific gas field in that area, and there are a number of pipe lines coming from that field.

Q. I see. When you are talking about Montana are you suggesting there that the governing body of the State of Montana has set aside certain fields to serve certain municipalities?

A. No, sir. I have no knowledge of what the actual governing bodies have done with regard to the supply.

Q. Let us come back, then. To your knowledge has there been anywhere on the continent any legislation or regulation by any governing body which has required the setting aside of certain fields

for a municipality exclusively?

A. I think -- if the Federal Power Commission would be considered a governing body?

Q. I would think probably they would.

A. Then, that is true. The Federal Power Commission requires the resources of such and such a quantity from so many fields to guarantee that there are gas supplies for the length and lifetime of the bonds or other financial arrangements to amortise the capital that is to be expended on the transmission lines from the fields designated.

Q. But is that not a different thing entirely from what you are talking about? You are talking about certain designated fields and saying they should be set aside for the City of Calgary?

A. That is right, sir.

Q. Do you know of any regulation or legislation by any governing body on the continent of North America where that has been done?

A. No, sir. I would like to study it.

Q. That is all I want. Now, do you agree with me that where you have a low load factor and a high peak that the consumer must anticipate paying extra to whoever supplies the peak?

A. Well, that is a very ambiguous question. We have been having gas supplied to the City of Calgary for forty years with peak loads, and we have paid those costs whatever they may be, but in

the case of Turner Valley, to be specific, there is no special price paid for peak load gas as such. It is the gas taken as required.

Q. Now, let me put it this way, Mr. Davies. You have been a petroleum engineer for more than thirty-five years, and you have considerable experience in other places than the Province of Alberta. From your knowledge of the gas business is it not customary throughout the world to pay additional amounts for peak loads?

A. The consumers pay it in the rates, yes; that is a matter of rate fixing.

Q. All right; I know it is. I just want to get it clear that there is extra pay.

A. I think you are mixing up two things. Consumers pay in their rates, in their schedule of rates, for peak load gas ---

Q. All right.

A. --- what might be termed a demand charge ---

Q. All right.

A. --- but that is paid to the distributing company.

Q. Yes?

A. Now, in this province the distributing company buys its gas from producers, and there is nothing in this province in any instance that I know of where there is any additional price paid for what

you term peak load gas.

Q. I see. Well, you will admit it is paid by the consumer?

A. Correct, sir.

Q. All right. Now, then, if a company such as Canadian Western is supplying Calgary, and Calgary alone, with a domestic load of 35 per cent, as you said this morning existed, from your experience is it not a fact that the cost of supplying such a low load would be considerably reduced if there was some way in which during the summer months, when the peak did not exist, the company could dispose of the gas so that the load factor of the disposal to Calgary and to the other purchasers was brought up to a point somewhere equivalent to the peak in Calgary? Do you follow what I mean?

A. I am not sure that I do.

Q. Well, you told us that you have a very high peak here in Calgary?

A. That is correct.

Q. And you have a very low load factor?

A. That is correct.

Q. And during the summer months if that differential between the load factor and the peak was capable of being disposed of then the unit cost would be greatly reduced, and the consumer in Calgary would benefit?

A. Would benefit at the expense of

exhaustion of his reserves.

Q. Well, the gas -- assuming there was no other new reserves being discovered, I agree, because of the fact that gas is a resource which becomes exhausted.

A. Let us take the facts as they exist in Calgary right now. We pay, and have done for some years, 10 3/4 cents. Say Canadian Western pays 10 3/4 cents to the Madison Natural Gas Company in Turner Valley.

Q. Yes?

A. Now, the Madison Natural Gas Company is a public utility.

Q. That is right.

A. Whether the Madison Natural Gas Company puts through a little or a lot of gas through their treating plant the consumer, through the 10 3/4 cents, pays the whole of those charges.

Q. Right.

A. If more units are put through -- that is, more billions of cubic feet in a year -- the charge per MCF is lower and there can be two beneficiaries. The producer can get more for his gas on the one hand. So far the consumers have not paid less for the gas. We have been paying 10 3/4 cents since 1949.

Q. Well, I do not think that was an answer to my question, Mr. Davies.

A. Well, let me -- I am anxious to answer it quite fully, and I think what you have asked me now is that if I take it at 10 3/4 cents and sell it some place else, and then am required to buy 18-cent gas to replace it, then I am better of, and I do not understand that.

Q. I did not say that at all, Mr. Davies. I asked you a question as to whether you would agree with me -- and I am not talking about any particular price now at all -- whether you would agree with me that if a company was supplying the gas requirements of Calgary with its load factor as it is ---

A. Yes, sir?

Q. --- and its peak as it is ---

A. Yes, sir?

Q. --- if it could find a purchaser for the differential between the load and the peak that the unit cost would be greatly reduced to the benefit of the consumer in Calgary as well as to the producing company?

A. Would it not depend entirely on the question of how much you get for that gas? If the price was exactly the same as the cost you would gain nothing. If the price was greater than the cost the consumers would gain.

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Q. Mr. Davies, you have not followed my question at all. I am assuming that a company has undertaken to supply the City of Calgary, and that company is confronted with a small load factor and high peaks: do you agree with me that the unit cost to that company of making the supply under those circumstances is higher than if it could dispose of a load in the vicinity of the peak throughout the year?

A. (Pause)

Q. Because if you do not, you are the only person I know in the world that would not agree with me.

A. I do not mind being in that position at all. It is a question that if you pay 10 3/4¢ for the gas ---

Q. I am not talking about the price at all.

A. All right, I will agree with you theoretically.

Q. Now then, is it not a fact that there has to be other sources of gas made available to the City of Calgary if the peak loads that you foresee in the future are going to be met?

A. That is right.

Q. And one of the proposals put forward by the utilities supplying Calgary is that they develop the Carbon field?

A. Correct.

Q. And that the Carbon field be used for the purpose of supplying the peak loads?

A. Correct.

Q. Have you done any calculations, at all, to determine what it would cost to develop the Carbon field as proposed by this supplier and how much it would cost the consumers in Calgary to have this peak load gas made available to them through that force?

A. We are in a process of doing this. We have two engineers working on it. We hope to have that material ready for a hearing on the 25th, or thereabouts, of February.

Q. But you do not have them ready at the moment?

A. Ours are not ready. This morning I gave you a figure of 8¢ based on the Canadian Western figures supplied to us for the years 1958 and 1959.

Q. They say it would cost 8¢ on their figures.

A. That is what I say.

Q. Now, on the proposal you are putting forward in designating these fields, have you done any work to figure out what that would cost the City of Calgary, presumably?

A. Yes, we have the additional cost --

so far as Madison, it is small. It is a question that we have to pay this cost in any event and there is more MCF going through, so the additional cost is a small matter as it is taking gas from Sarcee. The question of East Calgary at the moment buying gas at a high load factor at 18¢ is a proposal which we have not agreed to, and it is a proposal that depends upon finding a market for a vast quantity of sulphur. In the event that a market for sulphur is not available or a permit is not granted to Westcoast, it then is a question of a treating plant for the Elkton alone, and that is for a 50 million cubic foot plant as a public utility matter with no transmission lines, and the cost, on the most recent figures I can get, is around $3 million.

Q. What I am trying to arrive at, if I can: how much do you say, if your proposal was carried out, would it actually cost the consumer in Calgary? You said the Canadian Western scheme would increase the cost 8¢. How much would your scheme increase the cost?

A. I have not figured it out in cents, but I can give it to you very quickly. (Witness figures). It would be under 5¢ and over 4¢.

Q. Between 5 and 4¢, and is that predicated on your being able to get the gas through this designated gasfield at the same price that is being paid today of 10 3/4¢?

A. No.

Q. On what is it predicated?

A. It is predicated on what the competitive prices we have heard about, are: one was 16.7¢.

Q. It is predicated on those prices generally prevailing in the market today?

A. That is right. I must qualify that answer: when I say between 4 and 5¢, that is the treating cost prices and the cost of 15.75¢ over the 10.75¢, you get an 8¢ total.

Q. Then you come up to the same figure?

A. Did I? I want to point out something: I specifically mentioned the cost in the year 1958 and 1959. I did not mention the costs which subsequently must be added to the Carbon field, and that is the drilling of sufficient wells to produce more gas in the future and develop the field and establish the gathering lines -- that is, to produce the gas and gather the gas in the field, and we have been advised and intend to use it as a storage field. It is to be used as a storage field. It is a question of taking gas from some other field and pumping it back into Carbon in the summer months, and taking it out of there in the winter months. I have a figure of the cost of a compressor tank of some $6 million, and a cost of drilling wells of $1,600,000.

Q. If you are going to operate your fields at the most economical rate, you either have to have a high load factor or you must store. Is that so?

A. Not with sweet gasfields. You can take gas from sweet gasfields as the Conservation Board allows you, and they allow you to take more gas in the wintertime than in the summertime.

Q. Would there be very much incentive for people to go out exploring and looking for sweet gasfields if they were always to be immediately seconded to the City of Calgary, and it were only going to be operated for the peak loads that the City of Calgary might have?

A. We are not suggesting and did not suggest in the case of the City of Calgary they be operated on that basis. We suggested Carbon be operated and the gas taken from it on a volume basis. That is, so much gas be taken in each year. It is so stated in our written brief.

Q. What I had difficulty in following, Mr. Davies, is this: supposing Carbon was only to supply the City of Calgary all by itself? Am I correct in thinking that what you are suggesting is that it should operate during the summer months at 35 per cent. or 42 per cent. of capacity, and in the winter months it would operate up to 100 per cent. capacity?

A. As set by the Conservation Board, yes.

Q. And I am suggesting to you, if you had that situation there would not be very much incentive to go out and look for gas of a similar nature.

A. I do not agree with that at all. It is the amount or volume, the annual volume you sell in a year which, regardless of whether you take it out in five winter months in large volume and small volume in the summer months; it is what you take over the year that pays the interest charges and what gives the annual revenue to the producer. You have mixed, I think, sir, two factors. One is the question of conservation of gas and the other is the question of at what rate you take the gas out of the field. It makes no difference to the producer whether you take a lot out of a sweet gasfield, that is, a dry sweet gasfield, in an uneven rate per year, or whether you take it at 100 per cent. load factor so much every day.

Q. I see. You say it does not make any difference in the unit costs at all?

A. No, annually, no.

Q. Let us come for the moment to this proposal to which you referred this morning between Alberta & Southern and Canadian Western Utilities: am I correct in thinking that under that proposal

the Utility Company can purchase gas in 70 per cent. load factor from the Alberta & Southern at cost, and that for peak gas it can purchase it 1.3 times cost?

A. That is my understanding.

Q. And that it can also deliver gas, if it has it to deliver, as against these costs?

A. That is my understanding. Added to that it is the peak load gas portion they take over and then return 1.3.

Q. Or pay for it?

A. Or pay for it.

Q. As I understand it, you consider that such a proposal as that places a penalty upon the consumer in Calgary?

A. That is right, sir.

Q. But if the Utility Company, by such an arrangement, can increase the load factor of its lines and reduce its unit cost by, during the summer months, operating at full capacity and puttings its gas into the lines of Alberta & Southern, and then when the peak loads come upon it reverting to the City of Calgary or borrowing from Alberta & Southern, does not that result in there being a benefit in cost to the consumer in Calgary?

A. No, sir.

Q. Why not?

A. Because we pay the full cost of those lines whether they are operated in the winter time or in the summer time. They are public utilities.

Q. Yes?

A. And the full cost of those lines is paid by the consumers, whether operated at 90 per cent load factor or 10 per cent load factor.

Q. They are based, are they not, in the rates -- you are talking about rates, and the rates are set in Alberta by the Public Utilities Board?

A. I advise the City on rates, and I am perfectly familiar with them. I help make up schedules.

Q. I am not suggesting that you are not. I am simply suggesting to you, and I was going to ask you this: you are talking about rates that may be permitted by the Public Utilities Board of Alberta?

A. That is right.

Q. Am I correct in thinking that the way in which rates are determined is by arriving at the moneys that are invested in the operation?

A. That is right, sir.

Q. And, having arrived at the moneys invested in the operation, you determine the reasonable costs of the operation, and you permit the utility to

earn enough money on the moneys it has got invested to pay for its costs of operation, and make a profit of a certain percentage?

A. That is right, sir.

Q. Well, if its costs of operation are reduced as a consequence of having a full pay load rather than a 35 per cent pay load, isn't that bound to reflect in the rates?

A. I will see if I understand your question. We take gas from -- a specific case -- from Turner Valley.

Q. Yes.

A. For which we pay 10 3/4 cents.

Q. Yes.

A. We take it out of Turner Valley through Madison's gathering lines, which is a public utility, through their treating plant, which is a public utility, and we take that gas to, we will say, Calgary, because their lines come to Calgary, and then back out to the Alberta and Southern, or some other export line.

Q. Yes.

A. The cost to Canadian Western, unless you are visualizing the cost of transportation be put in there, which I have not heard of yet . . .?

Q. No.

A. If there is no cost of transportation credit in there, all we have succeeded in doing is

exhausting the reserve in Turner Valley of 10 3/4-cent gas, which later we will have to replace at 18 cents, which is the price they are offered outside of Calgary, and 15.75 from Alberta and Southern, plus the transportation cost.

Q. Yes, but isn't the whole answer to what you are talking about, that the Public Utilities is, in fact, buying from another public utility, and that price is fixed by the Public Utilities Board?

A. That is correct.

Q. Well, in all these fields around Calgary, which you say should be designated for Calgary, none of those would be a public utility, and the Public Utilities Board would have no authority to say what price they were going to get ---

MR.HELMAN: I object to that statement, Mr. Chairman; it is not correct.

MR. PATTILLO: You say the Public Utilities Board would inquire into that price, Mr. Helman?

MR. HELMAN: The Conservation Board would fix the price.

MR. PATTILLO: We have had the evidence from them, and they say they could not care less.

MR. HELMAN: They may say that.

MR. PATTILLO: They certainly told us that.

MR. HELMAN: The Act says that.

MR. PATTILLO: Let us assume they know how to administer the law, and they told us they couldn't care less.

MR. HELMAN: They may not care about it.

MR. PATTILLO: Q. Let us assume that the Conservation Board does not care?

A. Right.

Q. . . . as to what price the producer charges in these fields which you want designated.

A. Right.

Q. Then, the situation becomes entirely different from the Turner Valley Madison deal?

A. No. Let us take Sarcee: it is owned jointly -- part of it by Shell and part of it by Home Oil.

Q. Yes.

A. Canadian Western, if it wants to get that gas now has to go to Alberta and Southern under this contract. The gas which we wish to get from Sarcee is under 70 per cent load factor.

Q. Yes?

A. They will, therefore, have to pay 1.3 times that average field price for it. The gathering line from Sarcee would be owned by Madison Natural Gas Company, and the treating plant would be owned by Madison Natural Gas Company. I see no reason for paying 1.3 times that price because we take

it at 68 per cent load factor and not 70 per cent.

Q. What I have difficulty in following -- and I don't want to take very long with this -- but if there is no regulation body that is going to say anything to Shell and these other owners at Sarcee, do you mean to tell me they would be prepared to sell their gas for the same terms whether you took 35 per cent in the summer months and 100 per cent in the winter months, as if you took 100 per cent the year round?

A. I can't speak for the companies, but I will say that under the laws of this Province the amount of gas you take out of a well is properly set by the Oil and Gas Conservation Board and should not be set by contract.

Q. What you are meaning there is that the Board will determine the amount that you can deliver to the most economic use of that well without in any way endangering its future?

A. That is correct. That happens in oil wells; it is the policy with oil wells, and it should be the policy with gas wells.

Q. Supposing that is so, and they determine the quantity to be delivered every day, but you don't want in the summer months that quantity; you only want 35 per cent?

A. That is right.

Q. But in winter months you want it all.

Do you think, from your knowledge of the petroleum industry in thirty-five years, that a company would be prepared to sell on the same terms whether you take the whole of their available supply in the summer or whether you take only 35 per cent?

A. I am quite sure that if the annual volume taken is that set by the Oil and Gas Conservation Board, any company will be glad to sell under those terms.

Q. In the light of what you have just said, would you please look at page 2 of your letter of February 1st, 1958, Exhibit C-7-1, the third paragraph from the bottom of the page:

"The load factor in the State of
"California is more favourable than that
"of Calgary due to the difference in
"climatic conditions. Calgary con-
"sumers of gas cannot compete for
"gas supplies with consumers of gas
"in California because of load factor
"penalties, due to high consumption
"in Canada in winter months. Some
"form of protection for Canadian con-
"sumers is absolutely essential."

How do you make that statement fit with what you have just told me?

A. Well, it is a fact in both cases. I don't exactly know what is in your mind, but if you

ask me I will be very happy to try and answer it.

Q. You have just told us that it would make no difference to a company if they had a daily allowable and a yearly allowable, and if they were only selling 35 per cent of it, 35 per cent during the day during the summer months, and what they would be looking at was the annual increment -- annual sales?

A. That is right.

Q. Now, I concede that any allowable they would have would be based on the daily flow, wouldn't it?

A. No, no, I think perhaps there ---

Q. You think it would be on an annual base?

A. The Board sets the annual withdrawal on the basis of what it feels to be the maximum permissive rate -- the rate that is best for the field as a whole.

Q. Yes?

A. And it will permit up to 37 per cent of what is known as the absolute open flow.

Q. Yes?

A. But it would not allow you to take 37 per cent of that absolute open flow every day of a year, or anything like it. So, it will allow you, in the case of sweet gas fields, and in some low acid

gas fields, to come up near that 37 per cent during winter months, but you must compensate for it by going down in summer months, so that your annual rate of withdrawal shall not exceed the percentage set by the Board. Do I make myself clear on that?

Q. Yes.

A. You can do it in one of two ways: you are limited in all these cases by your pipe line facilities. If you are taking gas 1,500 miles, it is quite a different situation from taking it 20 miles. We can take gas 20 miles on a very low load factor, but it becomes quite impractical to take gas 1,500 miles on a very low load factor.

Q. I appreciate that, but I still don't understand, in the light of what you have been saying, and what you have got in this paragraph here which I just referred to. Now, may I ask you this question: When you agree as you do in your figures as to the present available supplies of gas, do you also agree with the Board as to their estimate of the future probable supplies being in the vicinity of 80 trillion?

A. No. I haven't made a study of the future.

Q. Do you agree that if the present tempo of exploration and drilling that has continued for the last several years in Alberta is continued, the quantities of gas that will be available will undoubtedly increase substantially?

A. I agree with that. May I add something to this?

Q. Yes.

A. Because of the deep drilling conditions along the foothills, you have much higher cost per well.

Q. You were talking this morning about this Elkton field, Elkton formation. You were using the figure of 65 -- it is at page 3 of your Table A, under "The Calgary field, the Elkton formation". It also appears in Table B.

A. Yes, sir.

Q. And you come up with the figure of 65.6 billion.

A. That's right, sir.

Q. Now, to your knowledge, has industry placed a much higher figure than that on that field?

A. Would you repeat that question? Industry, did you say?

Q. Yes.

A. Oh, Westcoast has a much higher.

Q. In addition to Westcoast, has any other company in the industry placed a higher figure?

A. Not any company that I know of. I know of an individual report that purports to give 600-and something. I am giving it from memory.

I would like to refer to what the Board has done in the very same field, and they give it as 50 billion feet. The Board's information is recent; our information is recent and, as far as we are concerned, is information including the month of January of 1958.

Q. Are you aware that in August, 1957, the Jefferson Lake Sulphur Company submitted that, in their opinion, there was a provable recoverable quantity of 416 billion cubic feet in this formation?

A. I know there was an estimate made but I didn't recall the exact figure.

May I also point out that since that report was made there was a well drilled and didn't find any at all, which accounts for a vast difference in estimating.

Q. You say the proven figure since that time has not been satisfactory?

A. Well, on that estimate it threw it right out altogether, otherwise neither the Board nor ourselves would have come up with the figures which we have done with regard to the Elkton and East Calgary.

Q. May I ask you to look at your letter of February 1st, again, and Clause 9 at the top of page 2, which reads: "The price of gas to Canadian consumers and specifically to Southern Alberta consumers, should not be higher than costs of production and a fair return on capital warrant. Export corporations are competing with each other for supplies of gas for export to the United States."

Now, what are you suggesting there, Mr. Davies; that there should be a two-price system,

one price for export and another price, a control price, for the consumers in the Calgary area?

A. We had not got to the stage of considering exactly how the price to Canadian consumers can be protected. There is a possibility that there should be two prices. I heard it discussed.

Q. Supposing that that was put forward. Have you given any thought as to how the producers would be regulated as to their price and their production for the home market; how they would be compensated for the difference between that and the free price paid by the people who were exporting?

A. The matter has been discussed and we get into the question of the demand in California, which is a very large demand and is increasing and will increase, according to the Chase National Bank, to very large proportion; and we, in Alberta, if something is not done in some form, can find ourselves paying very high prices for gas, not because of the cost of production and not because of a fair return on capital, but because somebody else comes along and bids more for the gas than we can afford to bid.

Q. Well, Mr. Davies, hasn't it always been your experience that -- take the people of Calgary and their proximity to these gasfields, and the people, say, in the City of Los Angeles and

their proximity to these same gasfields, and assuming that the price was the same at the well-head: the transmission costs would certainly be different and the people of Calgary would be getting their gas more cheaply, delivered, would they not, than the people in Los Angeles?

A. The people in Los Angeles, using a very small amount of gas annually -- each man that has a pay cheque can afford (and in setting rates it is a factor to be taken into consideration very carefully) each man allots so much, consciously or unconsciously, to pay his fuel bills. If a man in Los Angeles only uses, in the example I gave this morning, 100 MCF annually, his rise in cost of $15 means a rise in cost of $32.50 up here. The man in Canada still has one pay cheque and one pay cheque only.

Now, it is a question of long-distance lines. Where you have storage fields, fields that may be cut back, the very thing you were objecting to a while back, the gasfields in the State of California that can be sheltered in the summertime, gas can be taken at a high load factor of much less than 2¢ 100 miles, because in Southern California, wells have a much higher price than in Alberta, you get to the point where the overall cost to the consumer in Southern Alberta is nothing like the overall cost to a consumer, generally,

in Canada, because of a difference in climatic conditions, the difference in the number of degree days that we must heat.

So Southern California can afford a market, generally, and is definitely a competitor for Canadian gas; and the source of supply is Alberta, at the moment, the prospective source of supply is Alberta, and it is a very definite factor.

I do not think that Eastern Canada can compete on even terms with a market in the State of California, and it gets down to a question of whether Canadian gas is to go to California or whether it is going to serve the citizens of Canada generally, and that is a matter for the Commission to determine.

Q. I agree with you, Mr. Davies. That is one of the problems before the Commission. But what I am trying to get at are the assumptions you have been making. If gas is sold by a producer or a field within 150 miles of Calgary and part of its production goes to California and part comes to the City of Calgary, the price at the wellhead is the same in each instance. You would agree that the cost at the gate of the City of Calgary would be considerably less than the cost of a similar quantity of gas at the gate of Los Angeles?

A. Oh, correct; you add the transportation charges.

Q. Yes.

A. Yes.

Q. Well, from your experience in economics, if both the City of Calgary and the City of Los Angeles are paying the same price at the wellhead 150 miles away from the City of Calgary, where is the injustice in that? So long as there are supplies available for the City of Calgary and there is no danger of them going short, where is the injustice in them both paying the same price at the wellhead?

A. The point has been raised, over and over again, that there is no transmission charge on the gas in East Calgary, 6 miles from the City limits. In fact, it comes right to the City limits. Having no transmission charge, that gas is cheaper, to us, by eliminating the transmission charge. By reason of these other plants and lines which are in existence now, other fields, like Sarcee, can be tied into the existing system at a saving to the consumers. We would like it done, instead of competing and putting ourselves as competitors with the City of Los Angeles for new fields, higher cost fields at a greater distance from the City of Calgary.

Q. Now, you were objecting to this proposed 1.3 cost of peak gas in the Alberta and Southern contract. If Carbon was developed by the utility so that it was capable of supplying all of the peak load requirements of Calgary would you agree that there would be no need of the utility acquiring its peak gas from Alberta and Southern under this contract?

A. If there was sufficient gas in Carbon to do so we would be in the position that indirectly we have an investment in Carbon -- made an investment in Carbon -- of some millions of dollars in order to put Canadian Western in the position of buying gas from Alberta and Southern at a 70 per cent load factor. I would say something to that; we are in the process of making a detailed examination of Carbon. I do not want to say before this Commission that there are not 206 billion cubic feet in Carbon at this time. We will submit the data to the Commission and it will be a most detailed examination, and having that data before it this whole matter will, I think, become much clearer as to what the value of the Carbon field is from the point of view of peak load gas.

I will give you just one example. On the basis of the data that we have now the annual charges on the money that Canadian Western proposes to invest amounts to approximately $2 million a year. That is based on a 7½ per cent return. Canadian Western have made application for another formula for

calculating the rate of return and the amount of it, and I am assuming that it will be rejected. If it is not rejected the $2 million will be higher. That $2 million includes rate of return, operating expenses and amortisation on the capital invested during the year 1957 and the year 1958. If 2 billion cubic feet a year was taken from the Carbon field and the annual charge was $2 million that gas would cost the consumers in Calgary a dollar a thousand.

MR. HELMAN: May I say for the information of my friend that Professor Flock is going to give us some figures, and I am hoping to call him in the not too distant future. The figures are not ready. He will give us the results of a detailed examination of the Carbon field, and tell us exactly what in his view it has in the way of reserves.

THE WITNESS: Now, the investment in the Carbon field must all go against the domestic consumers, and if there is any way of avoiding it it is the duty of those working for the City to find the best possible scheme to supply that peak load without going to Carbon. There is another alternative. If gas was taken from the area of which Carbon is a part -- there are a number of other fields such as Hussar and Chancellor which are some distance from the Trans-Canada line. If all of those reserves were taken together then there is a possibility of taking gas through a 16-inch line and taking

sufficient volume of it, and buying the gas not in the ground, but as required at some figure to be negotiated with the owners, then we have not got this very high investment and we have not got this problem of $2 a thousand for gas.

MR. PATTILLO: Q. Now, Mr. Davies, let me ask you this question, and then I think I will conclude my examination. If precautions were taken to see to it that gas sold for export into the United States was sold at a provident price which yielded a profit, and if precautions were taken to make certain that there were adequate supplies to meet all the requirements of the consumers in the Province of Alberta, would you agree that you would be requiring the producers to subsidize the consumers in the Province of Alberta if you did not permit them to sell the gas at the best price they could attain?

A. I think that is right.

Q. And would you agree with me that it would be discriminatory to require any producer because of the proximity of his well or field to the City of Calgary to accept anything less than the best price that was being offered for his gas provided there were adequate supplies available to meet the requirements of the people of Calgary?

A. I do not argue with you at all. We do not suggest, and we have never suggested,

that the producer be not paid a competitive price for any gas that we have asked to be preserved for the City of Calgary. There is no discrimination whatever.

Q. Then, under those circumstances it resolves itself solely into what scheme can be the most economical and the least expensive?

A. To the consumers of gas in Southern Alberta?

Q. Yes, and that, I suppose, becomes a matter of opinion based on studies and cost figures?

A. Yes -- cost figures and strictly good sound technical judgment.

Q. And one of the factors, I gather from what you said this morning, in arriving at these cost figures would be the disposal of sulphur?

A. A very important factor, sir.

Q. And am I correct in this, if the utilities are putting forward a scheme as to how they are going to supply gas to the City of Calgary is there any Board in Alberta before whom they must go to present the scheme and obtain approval of it?

A. No, sir. It is a thing to which we object. They can go ahead with their scheme, commit themselves to deals, sign contracts, and then appear before boards -- that is the case in the Carbon field.

Q. And you will agree that the Federal Government at Ottawa can in no way pass legislation

that would deal with which scheme, wholly situated in the Province of Alberta, was to be adopted by the utility?

A. It is a legal question, and my technical opinion as an engineer is not of much value in that, but I would agree with you.

MR. HELMAN: I was just going to rise and say that that is a legal problem.

THE CHAIRMAN: Yes. I might make the comment that the lawyer and the engineer have agreed.

MR. PATTILLO: I observe it is the normal time for recess. I do not think I have any further questions, but perhaps I might reserve the opportunity of asking Mr. Davies any further questions if I find I need to do so after the recess.

THE CHAIRMAN: We will adjourn now for ten minutes.

---A short recess.

THE CHAIRMAN: The Commission will now resume, gentlemen. Mr. Pattillo?

MR. PATTILLO: Q. Mr. Davies, I just have one question, or one series of questions, further. If you agree with me, as I understand you do, that the prices paid for gas should be the competitive prices prevailing to the producer, then does not your scheme for setting aside designated fields for the use of Calgary only in effect require the

owners or producers of those fields to subsidize the City in that although they will get competitive prices they will only get paid those prices as and when the City of Calgary sees fit to use the gas?

A. Theoretically, yes. Actually we propose to take the gas on the basis of the Oil and Gas Conservation Board's allowable as they lay it down.

Q. And your scheme envisages that if the fields had an allowable of so many cubic feet the City would take those allowables, even though the pay load, in the summer months particularly, did not equal those quantities?

A. In the deliverability table we have shown exactly how we propose to do it, and in the case of Okotoks and in the case of Crossfield -- the Okotokos field we have taken at 100 per cent load factor, and with the sulphur at Crossfield we have taken that at 80 per cent load factor on the basis of taking the Oil and Gas Conservation Board's formula for allowables, and the maximum we think that the Board would allow.

Q. So that you do not agree that proximity to Calgary of a producer would be any detriment under your scheme?

A. No, sir.

MR. PATTILLO: Thank you, Mr. Davies.

MR. HELMAN: Mr. Davies ---

MR. PATTILLO: Just one moment, Mr. Helman.

I think before you re-examine I should say that the procedure we are following is that Mr. Frawley, as counsel for the Province, will examine now, and you will wind up the examination.

MR. HELMAN: That is quite all right. We did it the other way the other day when I was here.

MR. PATTILLO: Well, the reason for that was that Mr. Frawley did not elect to ask any questions.

MR. HELMAN: I see. He is representing the Crown?

MR. PATTILLO: Yes, he is representing the Province.

THE CHAIRMAN: Mr. Frawley, do you wish to ask any questions?

MR. FRAWLEY: I thought I heard my friend, Mr. Helman, saying something, and I did not hear it at all. Now, it happens in the case of Mr. Davies that I have not any questions to ask.

MR. HELMAN: Now is it permissible that I ask questions?

MR. PATTILLO: Yes.

THE CHAIRMAN: Yes, Mr. Helman.

MR. HELMAN: Q. There has been some considerable discussion about taking gas and various allowables and at various load factors, and so on. Let us just look at the Pembina fields, which is one of the large producers of sweet gas. It is a fact,

is it not, Mr. Davies, that the sweet gas that is produced from the Pembina field varies from day to day having regard to the allowable that the Government permits?

A. That is correct, sir.

Q. So that there are no fields with constant load factors?

A. That is correct, sir.

Q. And when we take the sweet gas field -- and I think there was some confusion between yourself and Mr. Pattillo on this problem -- there is no difference whether one day the well is shut in and the next day you take the full capacity of the sweet gas field as long as over a period of time you take the full amount that you propose to take?

A. Provided when you take your full capacity it is in accordance with the regulations of the Oil and Gas Conservation Board?

Q. That is so; as much as the regulations permit?

A. That is right.

Q. So with the sweet gas field we have not any of these problems of load factors involved in it?

A. No, it is a question of market demand.

Q. Now, I just want to clear up this problem of the fields that are reserved near Calgary. As I understand it, Mr. Davies, those fields will

be used to their full capacity having regard to whatever the Conservation Board allows?

A. That is our proposal, sir.

Q. And, therefore, if the export companies were taking that gas they would not be taking it in more rapidly than the City of Calgary?

A. That is correct, sir.

Q. And when the City of Calgary is taking the gas from those fields that are reserved the advantage to the City of Calgary is that they do not have to pay large transportation costs?

A. That is right.

Q. And it is because the export companies will come in and take a considerable part of these close fields under the export scheme that Calgary would be forced then to take gas from more distant fields?

A. That is right.

Q. And that will add up to the additional cost in transmission?

A. That is right.

Q. And that will also mean that these more distant fields will have gas in them that ultimately will be more expensive because, as I think you explained before, you are getting into the foothills where the drilling is deeper?

A. That is correct.

Q. And we will also be getting wells with large sulphur content?

A. That is very correct.

Q. And we have the problem of the disposal

of sulphur affecting the quantity of gas that will be available and the same is true with regard to crude oil; as the crude oil market varies or the quantity from the crude oil field varies you are then in a more difficult position as to your equal products?

A. That is right.

Q. As I understand you, with regard to the Elkton reserve, that is something on which Dr. Flock has made a study?

A. That is right.

Q. And he is now making a study of the Carbon reserve?

A. That is right.

MR. E. J. CHAMBERS, Q.C.: Mr. Chairman, have I your permission to make a statement on behalf of Westcoast Transmission at this time?

THE CHAIRMAN: Yes.

MR. CHAMBERS: I am instructed by my client, Westcoast Transmission Company, to say that they disagree with many of the statements and facts and conclusions presented to the Commission today by the first witness for the City but Westcoast Transmission is of the opinion that cross-examination of the witness would not produce a record useful to the Commission. However, Westcoast does not want the Commission to gain the impression that because cross-examination is not conducted by it that it, in

any way, agrees with the statement made. With the permission of the Commission Westcoast will submit any comment that will be useful to the Commission at the time of the presentation of Westcoast's own evidence and at that time it will produce such witnesses before the Commission as are necessary to support those comments.

THE CHAIRMAN: Thank you very much, sir. Is that the completion of the brief of the City of Calgary for today?

MR. HELMAN: No, I want to call Mr. Martin.

MR. PATTILLO: They are going to call one other witness but it may be that the Commission may want to ask Mr. Davies some questions.

MR. COMMISSIONER HOWLAND: Mr. Davies, I revealed my ignorance yesterday in trying to get at the maximum efficiency rate. Today I am going to do it by asking you this: If we are assuming that the reserves of the Province are reasonably large and that the price of gas will go up if you have an export market, it would seem to me that the possibility of coming the other way on this question might have been looked at. Possibly you can tell me that it has been. It has occurred to me you might look at this from the point of view that the rise in prices would lead to a very considerable increase in the gross national product of the Province itself. I am looking at it now and, say, 2 cents more per

thousand cubic feet then when you see the trillions we have been talking about this looks like a lot of money. What I am talking about is that Calgary is a very important segment of the Dominion economy which now has a greatly increased gross national product. Do you feel that the consumer of gas in Alberta under your supposition might be required to pay more money for his gas but he might, also, as a community gain greatly from Calgary's share in the prosperity of the Province. What I am thinking about is: you might pay $34 more for your fuel or your energy but by reason of the larger policy you gain $100. Has there been a study of this nature?

A. There has not been a complete study of that nature for this reason: it is a matter we do not touch on at all. In this area we have competitive fuels; one is coal and the other is oil and we have considered this a great deal. If the price of gas rises materially some of the larger industrial consumers are going to consider other fuels. The net result of that would be a drop in the overall quantity of gas sold and the load that is lost is a high factor load. The loss of the high factor load means that all the expense,then, eventually falls on the domestic consumer. The effect of that on the gross national product, so far as Calgary and

Lethbridge are concerned, is a question that has to include the cost of coal and the cost of oil and where the cost of gas reaches a competitive figure for oil, we then get into the position that it may not mean an increase at the figure you contemplated or indicated. It might reach a net overall result where the expense is entirely borne by the domestic consumer because the domestic consumer is going to burn gas even at higher prices than we have today but the industrial consumer would not do that.

Q. Would the load factor not be better if you were turned into an export market?

A. As far as the citizens of Calgary are concerned, our load factor is not dependent on export, it is dependent on our climate.

Q. I am making the supposition it would be tied to it. I am not arguing the case, I am asking the question: It occurred to me, just as you spoke about the coal industry, if the price of gas went up by reason of exporting, there may be some of the marginal markets in the coal industry they might well serve. You do not know of any studies made along those lines?

A. No, sir, not when you get down to figures on gross national product.

MR. COMMISSIONER HARDY: Mr. Chairman, I wonder if I might refer to the question Mr. Helman asked Mr. Davies a few minutes ago in connection with

the deliverability of gas from the Redwater field on page 10 of the brief.

THE CHAIRMAN: Certainly.

MR. COMMISSIONER HARDY: Most of the gas from the Redwater field is shown under column 14 and it is headed Solution Gas?

A. Yes, sir.

MR. COMMISSIONER HARDY: From your answer and the point that Mr. Helman made I took it that it only refers to solution gas?

A. It refers to solution gas.

MR. COMMISSIONER HARDY: In other words, availability of the gas depends on the regulations of the Conservation Board for the production of oil?

A. That is right.

MR. COMMISSIONER HARDY: Now, if you look at page 3, in the Calgary field and also the Carbon field the available gas is in column 16 and that is non-associated gas?

A. That is correct.

MR. COMMISSIONER HARDY: The deliverability regulations would be quite different, would they not, for non-associated gas?

A. That is right.

MR. COMMISSIONER HARDY: As compared to the solution gas?

A. That is right. The only field we have on the Calgary gas on solution gas is the solution

gas in Turner Valley.

MR. COMMISSIONER HARDY: What is that again?

A. I said in the Calgary system field, the only system in which we have solution gas is the solution gas from Turner Valley.

MR. COMMISSIONER HARDY: Then your answer is correct to Mr. Helman in relation to Redwater?

A. That is right.

MR. COMMISSIONER HARDY: That Mr. Pattillo might also be quite right in his contention where you are dealing with non-associated gas?

A. That is right.

MR. COMMISSIONER CUSHING: Mr. Davies, on this matter of the agreement between Canadian Western Natural Gas and the Alberta and Southern on this 1.3 return for peak load, has that ever been used, to your knowledge?

A. No, sir. I have never heard of it before. That is a new one to me.

MR. COMMISSIONER CUSHING: Well, they have an agreement to that effect. Has it been effective; has there been an exchange of gas?

A. No, sir, it was signed in August of this year.

MR. COMMISSIONER CUSHING: It is a new arrangement?

A. That is right, sir.

MR. COMMISSIONER CUSHING: It would appear and I would presume the Canadian Western Natural Gas Company has protected itself for future needs in areas as close as possible to the City of Calgary. It would appear from the evidence you have given that might not be the case. Do you know if that is the situation there?

A. The situation at the moment is the contract with Alberta and Southern is the instrument that protects them. Alberta and Southern hold the contract, as I understand it, on Sarcee and Westcoast Transmission hold a contract on the Calgary fields.

MR. COMMISSIONER CUSHING: Have the City of Calgary a contract with Canadian Western Natural Gas Company in which they place an obligation on the Gas Company to provide gas?

A. That is a legal question.

MR. COMMISSIONER CUSHING: Is there a contract between Calgary and the Canadian Western Natural Gas Company?

MR. HELMAN: Perhaps I can answer that question for you, Mr. Cushing. The so-called franchise in Canadian Western is under a by-law that was passed pursuant to gas, water and electricity and giving them the right to use the streets. It is a non-exclusive right and they have no obligation on their part to supply gas to the citizens of

Calgary.

THE CHAIRMAN: Thank you very much, Mr. Davies,for all the information you have given us here today. The Commission appreciates, very much, what you have done.

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MR. HELMAN: Mr. Chairman, I will call Mr. Martin.

A.G. MARTIN, called

BY MR. HELMAN:

Q. Mr. Martin, what is your position with the City of Calgary?

A. I am the city planner for the City of Calgary.

Q. You have prepared a part of Exhibit C-7-1-A -- that is, the white book -- under Part C, dealing with population potentials of Calgary: would you mind reading that for the Commission?

A. Mr. Chairman, members of the Commission: Population growth is a highly unpredictable phenomenon, subject to a great variety of influences which may upset the most well-established patterns and trends. An analytic study of the population of any large urban centre such as Calgary, which, in its short existence, has experienced great and sudden fluctuations ranging from extravagant increases to actual decline, reveals wide variations in the population patterns of specified periods, in the trends of population change from period to period and in the forces and controls which are the external determinants of these patterns and

trends. To make valid population projections, then, it is not sufficient to know just the patterns and trends in existence at the time: the possibility of changes in them must also be explored. Predictions must be made of the variations in national and international politics and economics which are likely to affect immigration practices; of the changes in social concepts which may influence birth rates; and of the social and medical advances which may significantly alter death rates and the age structure of the population.

In the case of the Calgary metropolitan area a detailed study on the above lines has been carried out but, unfortunately, there is not sufficient recorded information available to give such a complete treatment to the City of Lethbridge and the several smaller centres also under consideration. Within the limits of existing knowledge, however, the projections made for these centres are perfectly logical and should prove no less acceptable than those for Calgary.

Population Projections: Metropolitan Calgary: A study of the population growth of Calgary reveals two significant trends, a short term and a long term. The long term trend, which can be dated from 1916, after the fever of the land boom subsided, shows that Calgary, through all its vicissitudes, has maintained an average annual

increment of three per cent. Since 1948, however, the great post-war immigration boom has created a new trend and the average annual increment has increased to seven per cent. The principal difficulty in estimating Calgary's future population lies in predicting just how long this increased rate will continue and whether it will cease suddenly or gradually. No indication is given by present statistics. The total population increase from 1956 to 1957 was the equivalent of 7.4% or, excluding the people brought into the City by annexation, 6.5%. This last figure cannot be interpreted as the beginning of a decline, however, because since 1948 the annual increase has ranged from 5.0% to 8.9% with absolutely no pattern at all in the fluctuations.

There are two components of population change which must be considered. The first, natural increase, the balance between births and deaths, is comparatively stable though showing a slight rise over recent years; the other, migration, is highly variable with the balance between immigration and emigration liable to extreme fluctuations. In recent years, however, there has been a very pronounced net immigration balance and it is this which has been largely responsible for the population increase since 1948. Of the seven per cent annual increment, less than one-third (2.25%) has been due to natural increase and as there is, at the present

time, no predictable likelihood of a major variation in this rate any change in the pattern will be the result of a change in migration.

The birth rate has recovered from the low level of the depression and war years but now shows only a very slight annual increase which may well be offset in the future by a steadily decreasing family size (from 3.5 persons per family in 1941 to 3.3 persons in 1951). The death rate has been remarkably stable since 1916 and though it has shown a consistent, and latterly quite marked, decrease since 1948 this is largely a reflection of the great influx of young adults and must be expected to increase again as the rate of immigration steadies and the population gradually ages.

Because of the consistency of the death rate, natural increase parallels the more volatile birth rate, showing the same low level of the depression and war years and not until 1955 surpassing the previous high recorded in 1916. If the possibility of further international catastrophes is excluded, however, both birth and death rates seem likely to stabilize at approximately their present levels and, for this reason, the population estimates are based on a continuation of the 2.25% rate of natural increase rather than on a steadily increasing rate.

Immigration, on the other hand, is much

more delicately balanced and though officials approached on the matter were not prepared to make any predictions it seems certain that a decrease must be anticipated. On the national scale, immigration is controlled by the absorptive capacity of the Canadian economy and though people are needed to develop the resource potential of the country it is obvious from the ever-present unemployment problem that large-scale immigration will be carefully regulated. There are already indications of a more restrictive policy towards people of non-British origin and this will undoubtedly affect Calgary, though perhaps not as much as other parts of the country which do not experience the intra-continental movement created by the oil industry. Even this, however, is not likely to be the same force in the future as already the boom days of extravagant expansion have passed and the industry is settling into a more consolidated and stable position.

Because of these factors, the population projections for metropolitan Calgary have allowed for a continuation of the present high annual increment for a further five years to 1962 and from then on are based on the long term increment of three per cent per annum. This anticipates that the present stable rate of natural increase will not be disturbed and provides for an annual net immigration

balance increasing from 2,250 in 1962 to 4,465 in 1987, figures which would not seem unreasonable for normal circumstances. Also, despite the apparently very sharp decrease after 1962, the projections really provide for a gradually declining rate of population increase between 1960 and 1967, a trend which must be expected as a concomitant of gradually increasing economic stability.

2. City of Lethbridge: Despite a steady growth in the post-war years, the City of Lethbridge has always been overshadowed by Calgary and its expansion has been largely an expression of the more intensive settlement that irrigation has made possible in its rural hinterland. It has developed almost solely as a service centre for the agricultural region of South-Western Alberta and has not even had the advantages of such industries as utilize agricultural produce.

That should not be an absolute statement there, Mr. Chairman, because there are some industries in Lethbridge which are based on agricultural produce.

With the recent establishment of regional planning and industrial planning authorities, however, it is expected that the industrial potential of the Lethbridge hinterland, based particularly on its varied mineral and agricultural resources, will

be more fully realized and exploited to the benefit of the city and some of its larger subsidiary towns.

Because of this major factor, it is anticipated that Lethbridge's period of greatest expansion is yet to come and that its development during the 1960's will compare with that of Calgary during the present decade. Also like Calgary, it is anticipated that after a boom period of industrial investment there will follow a gradual stabilization, probably early in the 1970's, and that growth from then on will be due mainly to natural increase supplemented by a certain amount of immigration from the surrounding district.

The population projections for the city of Lethbridge are therefore based on a steadily rising rate of annual increase for the first fifteen year period (from 3.5% per annum in 1957 to 5.0% per annum in 1972) and thereafter at the decreased rate of 2.5% per annum to allow for its more stable and balanced economy.

3. Group "A" Towns - Banff, Claresholm, Cochrane, Granum, High River, and Taber: All of the small towns in the group listed above are likely to experience considerable growth in the immediate future and, in fact, four of them (Claresholm, Cochrane, Granum and Taber) have already shown exceptional expansion in the period 1946 - 1956. Three of these four are subsidiaries of Lethbridge and as they have quite clearly benefited from the rural intensification brought about by irrigation, it can be expected that they will also share in the industrialization of the Lethbridge region. Of the others, High River and Cochrane are both on national highways and within Calgary's sphere of influence and may well develop as dormitory satellites or "new towns" complete with their own industries, while Banff will almost certainly take on new significance as a transportation and tourism centre with the completion of the Roger's Pass section of the Trans-Canada Highway.

Since 1946, these towns (excluding Banff as statistics were not available) have had an average annual increment of 7.5% and the projections are based on a continuation of this trend until 1967. This allows a ten year period of accelerated development which should be adequate for all the towns except possibly High River, the main development of which may be later as it will

depend on a policy of decentralization from Calgary. From 1967, the population of the towns has been projected at an annual rate of three per cent, slightly higher than the Lethbridge rate because the birth rate is significantly higher in the rural centres than in the cities. This rate also allows for a slight immigration balance, drawing on rural areas and nearby static towns.

4. Group "B" Towns - Canmore, Cardston, Exshaw, Fort Macleod, Magrath, Nanton, Okotoks, Picture Butte, Raymond, Stavely, Stirling and Vauxhall: This second group comprises towns and villages which showed only slight increases between 1946 and 1956 and which are not expected to experience any outstanding expansion. The average annual increment for these towns is only two per cent, less than the probable rate of natural increase, and they therefore show a net emigration balance. The population projections are based on the continuation of the two per cent annual increase until 1967, because a small number of immigrants (though not enough to offset the emigrants) can be expected during the general period of expansion, and at only one per cent per annum beyond that date as economic consolidation will bring an end to immigration to these towns and a proportionately greater movement from them to the large industrialized towns and cities.

5. Total Population: The following table gives the estimated 1987 populations of the four urban classifications discussed above.

Metropolitan Calgary	613,304
City of Lethbridge	87,330
Group "A" Towns	50,794
Group "B" Towns	22,739
	774,167.

Industrial Potential and Alternative Power Sources: Although the population statistics provide an invaluable guide to the increase in demand for natural gas, they do not give the complete picture because it has been proved that the relationship between city size and industrialization is not a simple arithmetic one but a geometric one. This means that as a city increases its population its industrial development will increase not in a constant ratio but in a climbing ratio representing a gradually accelerating rate of expansion. The validity of this fact has been established by the American planner, Harland Bartholomew, through an exhaustive study of a large number of United States cities and the following table was adapted from his work:

Population of City	Industrial Land as Percentage of Developed Area
50,000 to 100,000	4.79
100,000 to 250,000	5.84
More than 250,000	8.46

From this evidence it seems obvious that the Calgary of 1987 with its population of 613,000 will have a much higher proportion of industrialization than the present city and therefore a much higher natural gas consumption than would be expected from a simple comparison with population.

Table 5 gives the value of building permits issued for commercial and industrial premises between 1940 and 1956 and shows quite clearly how these heavy gas consumers have expanded in recent years. Prospects for 1958, with thirty-five million dollars worth of business construction already projected, do not indicate any slackening of the trend and with increasing awareness of the advantages of natural gas as both fuel and raw material for chemical and metallurgical industries and of Calgary's strategic location at the intersection of national and international highways and railways, no such slackening should be anticipated.

A further factor to be taken into account is the possibility of electricity generating stations powered by natural gas instead of the more usual water power. At the end of 1955, Alberta had an installed hydro-electric power capacity of only 212,000 kilowatts (1.6% of total Canadian development) and its potential was estimated at only one million kilowatts, less than 1.9% of the total Canadian potential.

I am sorry, Mr. Chairman, we did not give the source here; but the source was from the Gordon Commission Report on Energy Resources in the Province.

THE CHAIRMAN: Thank you.

THE WITNESS: It is obvious from these statistics that hydro-electric power is not likely to attain any new significance for Alberta in the future and if, therefore, the electrication of the Province is expanded it will be through the construction of thermally powered plants.

There, again, I should explain that statement somewhat, to say that of the resources still available in the Province, they are distributed over the three river systems, the Peace, the Saskatchewan and the Bow; and we are considering, here, the amount of additional power still available from the southern river, the Bow, when we make that statement.

The two fuels principally used for thermal generation are coal and natural gas, both found in abundance in Alberta, but when a choice between the two is possible it is natural gas which has the outstanding advantages of economy, cleanliness and ease of handling. The future expansion of electric power development will, therefore, also result in an increased demand for natural gas.

Canadian Western Natural Gas Co. Estimates Metropolitan Calgary: The Company's population projections for Calgary are calculated on a simple arithmetic increase of twelve thousand persons per annum, which would result in a population of 564,000 by 1987. This regular increment represents a continuous decline in the rate of growth from 5.0% per annum in 1960, which is rather low on present evidence, to 2.2% per annum in 1986, which is just the expected rate of natural increase and therefore makes no allowance for the immigration attraction of a large city. In the long term, the rate of increase is much more likely to remain constant than the numerical increase and thus provides a more logical basis of estimation.

Other Centres: The city of Lethbridge and the towns of groups "A" and "B" above are treated together in the Gas Company's statement along with seventeen other towns and villages. The total projection, which has been arrived at from a simple increment of 4,000 persons per annum, is 197,000 in 1987 and, when allowance is made for the additional towns and for new services which the Company is expecting to start, this comes very close to the Planning Department's estimate of 161,000.

Industrial Demand: In the Gas Company's statement provision is made for new industrial

demand at the rate of 1,000,000 mcf per annum, once again a constant numerical increase which takes no account of the anticipated acceleration in the rate of industrial development. Furthermore, the company's estimates make no allowance for new major consumers of the order of the three principal plants now in operation which between them use some 10,000,000 mcf per annum. In view of the natural resources of Alberta, this attitude seems more than a little unrealistic.

Q. Now, Mr. Martin, would you like to explain the figures which follow?

A. Well, I think I would prefer to do that, Mr. Helman, just in reading out the figures in detail, taking, first, Table 1, the population projections for metropolitan Calgary which includes the City of Calgary and the Towns of Bowness and Forest Lawn and the Village of Montgomery.

As explained earlier in the brief, we have explained the earlier expansion from the year 1948, say, which has been very close to 7 per cent. for another 5 years. After that we have decreased the net increase to a figure of 3 per cent., which comes closer to the long-term average increase for the City.

Naturally, one can expect a more gradual decrease as between the 7 per cent. and the 3 per cent. which occurs between the years 1962 and 1963;

but it is pretty difficult to arrive at something accurate at this stage of the game.

THE CHAIRMAN: Excuse me a moment, Mr. Martin.

Mr. Helman, could we not take these tables as read?

MR. HELMAN: I think so, because they have already been elucidated.

THE CHAIRMAN: Yes, in the text.

Table 1. Population Projections - Metropolitan Calgary.
(City of Calgary, Towns of Bowness and Forest Lawn, Village of Montgomery)

Year	Population	Rate of Annual Increase
1957	209,045	
1958	223,678	7%
1959	239,335	7%
1960	256,088	7%
1961	274,014	7%
1962	293,195	7%
1963	301,991	3%
1964	311,051	3%
1965	320,383	3%
1966	329,994	3%
1967	339,813	3%
1968	350,007	3%
1969	360,507	3%
1970	371,322	3%
1971	382,462	3%
1972	393,843	3%
1973	405,658	3%
1974	417,828	3%
1975	430,363	3%
1976	443,274	3%
1977	456,464	3%
1978	470,158	3%
1979	484,263	3%
1980	498,791	3%
1981	513,755	3%
1982	529,042	3%

Table 1 (cont'd

Year	Population	Rate of Annual Increase
1983	544,913	3%
1984	561,260	3%
1985	578,098	3%
1986	595,441	3%
1987	613,304	3%

Table 2 Population Projections - City of Lethbridge.

Year	Population	Rate of Annual Increase
1957	31,000	
1958	32,000	3.5%
1959	33,200	
1960	34,500	
1961	36,000	
1962	37,500	
1963	39,200	
1964	41,000	Gradually Increasing
1965	43,000	1957 - 1972
1966	45,000	
1967	47,250	
1968	49,500	
1969	52,200	
1970	55,000	
1971	57,600	
1972	60,300	5 %
1973	61,808	2.5%
1974	63,353	2.5%
1975	64,937	2.5%
1976	66,560	2.5%
1977	68,225	2.5%
1978	69,931	2.5%
1979	71,679	2.5%
1980	73,471	2.5%
1981	75,308	2.5%
1982	77,190	2.5%
1983	79,120	2.5%
1984	81,098	2.5%
1985	83,125	2.5%
1986	85,203	2.5%
1987	87,330	2.5%

Table 3. Population Projections - Group "A" Towns (Banff, Claresholm, Cochrane, Granum, High River, Taber)

Year	Population	Rate of Annual Increase
1957	13,732	
1958	14,762	7.5%
1959	15,869	7.5%
1960	17,059	7.5%
1961	18,338	7.5%
1962	19,590	7.5%
1963	21,059	7.5%
1964	22,638	7.5%
1965	24,336	7.5%
1966	26,161	7.5%
1967	28,123	7.5%
1968	28,973	3 %
1969	29,842	3 %
1970	30,737	3 %
1971	31,659	3 %
1972	32,603	3 %
1973	33,581	3 %
1974	34,588	3 %
1975	35,626	3 %
1976	36,695	3 %
1977	37,796	3 %
1978	38,930	3 %
1979	40,098	3 %
1980	41,301	3 %
1981	42,540	3 %
1982	43,816	3 %
1983	45,130	3 %
1984	46,484	3 %
1985	47,879	3 %
1986	49,315	3 %
1987	50,794	3 %

Table 4. Population Projections - Group "B" Towns (Canmore, Cardston, Exshaw, Fort Macleod, Magrath, Nanton, Okotoks, Picture Butte, Raymond, Stavely, Stirling, Vauxhall)

Year	Population	Rate of Annual Increase
1957	15,288	
1958	15,594	2%
1959	15,806	2%
1960	16,122	2%
1961	16,444	2%
1962	16,879	2%
1963	17,217	2%
1964	17,561	2%
1965	17,912	2%
1966	18,270	2%
1967	18,635	2%
1968	18,821	1%
1969	19,009	1%
1970	19,199	1%
1971	19,391	1%
1972	19,585	1%
1973	19,781	1%
1974	19,979	1%
1975	20,179	1%
1976	20,381	1%
1977	20,585	1%
1978	20,791	1%
1979	20,999	1%
1980	21,209	1%
1981	21,421	1%
1982	21,635	1%
1983	21,851	1%
1984	22,070	1%
1985	22,291	1%
1986	22,514	1%
1987	22,739	1%

Table 5 Value of Building Permits Issued for Commercial and Industrial Premises - 1940 - 1956

Year	Value in Dollars
1940	$ 231,398
1942	283,164
1944	388,714
1946	3,074,157
1948	3,008,833
1950	5,658,045
1952	6,783,352
1954	19,435,335
1956	24,193,802

MR. HELMAN: Q. I did not ask you, Mr. Martin, for your educational qualifications, to enable you to give this report.

A. Well, I am a graduate in architecture from the University of Manitoba, as of 1949, and I took my Master's degree in Architecture, mastering in Town Planning at the same university.

MR. HELMAN: I see. Thank you.

THE CHAIRMAN: Mr. Pattillo?

BY MR. PATTILLO:

Q. I only have one or two questions, Mr. Martin.

Where you state, at page 5: "This means that as a city increases its population its industrial development will increase not in a constant ratio but in a climbing ratio representing a gradually accelerating rate of expansion."

Which do you say comes first: the population, and then the industry; or the industry, and then the population?

A. Well, Mr. Chairman, it is a very difficult question to answer, but I think the two come together. I don't think one can place one as coming before the other, because, while I haven't figures now, there are figures which show that when a city increases beyond a certain point it seems to be self-growing. In other words, the very fact

that there is a large market there encourages further industrialization.

On the other hand, a big plant coming in can help to increase the population, so I don't think one can draw a fine line as to which came first, the industrialization or the population.

Q. The other question I was going to ask you was: from your experience, have you found that the cheapness of energy and the availability of it is of any real consequence in the determination of the location in industry?

A. Not from my direct experience, Mr. Chairman; but from my studies I am certainly led to believe that the location of the hydro-electric power, or any type of energy, is a determining factor in the location of an industry. You get radical cases and perhaps "radical" is not the best choice of words; but you get extreme cases like the new town up in Northern British Columbia, the name of which escapes me at the moment.

Q. Kitimat?

A. Kitimat, where the availability of the cheap power is everything. Now, that is an extreme case, at one end of the scale. In other words, in that instance it is much cheaper to bring all of the ore up to the industry. Now, that is extreme, and, in that particular case, there are large amounts of power required for the extraction of aluminum.

You might get other industries where the actual cost of the power is relatively insignificant.

Q. Relatively insignificant.

A. Yes. You might get, in any community, two extreme cases.

MR. PATTILLO: Thank you.

THE CHAIRMAN: Mr. Helman?

MR. HELMAN: I have nothing further to ask.

THE CHAIRMAN: Thank you very much indeed, Mr. Martin, for the very useful information you have given the Commission.

MR. HELMAN: So far as our being ready to proceed today, that concludes the evidence we have, Mr. Chairman. As I said, we have two other witnesses that we will want to call, Professor Flock and Mr. Workman.

MR. PATTILLO: When do you want to call them, Mr. Helman?

MR. HELMAN: I have to communicate with Professor Flock and see if he has completed his study on the Carbon field.

MR. PATTILLO: You certainly do not want to go on on Monday with either one of them?

MR. HELMAN: No.

MR. PATTILLO: Then, Mr. Chairman, we will proceed on Monday at the usual time with the submission of the utilities, The Canadian Western Natural Gas and North-Western Utilities Limited and, as I understand it, Mr. Helman will let us know when his witnesses can be available with their material and we will try to arrange it. Is that satisfactory?

MR. HELMAN: Quite satisfactory.

THE CHAIRMAN: We will do the best we can to suit your convenience in that regard, Mr. Helman. I think we will be holding to our schedule, in any event, because, as Mr. Pattillo says, you are not ready to go on on Monday.

Then, gentlemen, the hearing is adjourned for this afternoon and we shall meet on Monday morning at 9.45.

---Whereupon the hearing adjourned at 4.15 P.M. until 9.45 A.M., Monday, February 10, 1958.

Mr. Borden

ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

VOLUME No.: 5

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ERRATUM

It is regretted that, through inadvertence, the name of Mr. Yorath is misspelled at pages 589 to 625.

ANGUS, STONEHOUSE & CO. LTD.
TORONTO, ONTARIO

ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary, commencing Monday, February 3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.

Mr. Miles H. Patterson.

Mr. J.F. Parkinson -- Secretary to the Commission.

Major N. Lafrance -- Assistant Secretary to the Commission.

APPEARANCES:

Representing Canadian Western Natural Gas Company Limited and Northwestern Utilities, Limited:

Mr. G.H. Steer, Q.C.	-	Counsel
Mr. D.K. Yorath	-	President
Mr. B.F. Willson	-	Vice-President, Operations.
Mr. Carl A. Trexel, Jr.	-	Stanford Research Institute.

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A

Monday,
February 10, 1958

---Upon resuming at 9.45 A.M.:

THE CHAIRMAN: Gentlemen, we will now resume the hearings of the Commission. Mr. Pattillo?

MR. PATTILLO: Mr. Chairman, today, we propose to hear the submission of Canadian Western Natural Gas Company Limited and Northwestern Utilities Limited. We have here Mr. Yorath, the president of the company, Mr. Willson, who is vice-president and one of the senior officers, and Mr. Trexel, who is from the Stanford Institute, who have contributed a substantial document for their submission. Mr. Yorath will be giving the submission, as I understand it, and he will ask at times that Mr. Willson expand some parts of what he is referring to.

There is a good deal of the document, which I propose to have Mr. Patterson submit for marking immediately, which I am going to ask the Commission to take as read in order that we can expedite the hearing. On the other hand, I would like the company or Mr. Steer, if at any time I suggest something be taken as read which they would prefer to read, to ask that that be done.

I have suggested that the examination of these gentlemen be conducted in the same manner in which we conducted the examination of the Conservation

Board members, namely, that they all sit at the table, that I address questions generally, and that they elect among themselves as to who will answer.

THE CHAIRMAN: Is that satisfactory to Mr. Steer?

MR. STEER: Yes, sir.

MR. HELMAN: Mr. Chairman, may I make a submission as to something which arose in cross-examination of Mr. Davies, the witness for the City? I am only rising to make this point because I think it is of some importance. The witness was asked as to whether or not he knew that there were any other fields which were reserved for a particular community, and he said he did not know. Now, I understand that in Alberta there has been a field reserved at Medicine Hat for the City of Medicine Hat under circumstances with which I am not familiar, but the only other place we could go to ascertain whether or not there were fields reserved is the United States because that is the only place where we have developed long lines of gas communication between various States, and I have not had time to completely follow down the law, largely because the authorities are not available to me being United States authorities, and I will have to get them.

I am reading from a book by Professor Victor H. Kulp, who is Professor of Law at the University of Oklahoma, which deals with oil and gas

rights there. At page 779 you will find in this book that he makes the following statement:

> "The power of a state to prohibit pipe "lines from transporting natural gas "to another state has been tested in a "number of cases involving the validity "of statutes of different states. In "each case the courts hae held them an "unconstituional interference with the "right of the owner of the gas."

Now, you must remember that the United States Constitution makes a considerable number of things unconstitutional which are not unconstituion-al in this part of the world due to the United States provisions in the Constitution, and there is a case cited here in West Virginia, which I have not been able to get, but it is stated in the footnote here that it was dealt with here in 1929. By the way, these unconstitutional holdings started back as far as 1911, I take it from the footnote here, and in this case it was said the state could not require a gas company to sell its gas within the state if it could get a higher price elsewhere.

Then, there is a case in the Supreme Court of the United States cited in 1923 where it is held that the attempt by a state in which natural gas is produced to require preference in its use to be ac-corded local consumers -- and then it goes on with

other submissions -- was unconstitutional. That is in the United States Supreme Court in 1923. As I see it, any attempt on the part of any state to reserve gas for any particular community has been held unconstitutional in the United States, and we will not find any place where that has taken place, and that is the only place we can look for it.

Thank you very much, Mr. Chairman.

THE CHAIRMAN: Thank you, Mr. Helman.

Submission of

CANADIAN WESTERN NATURAL GAS COMPANY LIMITED

and

NORTHWESTERN UTILITIES, LIMITED

APPEARANCES:

Mr. G.H. Steer, Q.C.	-	Counsel
Mr. D.K. Yorath	-	President
Mr. B.F. Willson	-	Vice-President, Operations.
Mr. Carl A. Trexel, Jr.	-	Stanford Research Institute.

MR. PATTERSON: Mr. Chairman, might the submission which is about to be read be marked as Exhibit C-10-1, and since the appendices are contained in the same volume with it I do not think there is any need to allot separate numbers to them. Mr. Belanger already has a copy for marking.

THE CHAIRMAN: Very well, Exhibit C-10-1.

---EXHIBIT NO. C-10-1: Submission of Canadian Western Natural Gas Company Limited and Northwestern Utilities, Limited.

THE CHAIRMAN: Who is the first witness?

MR. YORATH: Mr. Chairman, the companies I represent are pleased to present to the Commission the benefit of their experience over nearly fifty

years as producers, transmitters and distributors of natural gas within the Province of Alberta and also their views as to how the present and future gas supply problems of Alberta consumers can be solved.

Now, Mr. Chairman, throughout the narrative of this submission I will be referring to certain statements, tables and charts under the tabs attached to the submission. There is an example in connection with this next paragraph where I would refer you to Tab O, which is the report prepared on the annual market requirements and peak day loads of our two companies. It was prepared for our information and guidance, and for the information of the Conservation Board. It was mailed to the Board late last summer, and a particular reference is made in the next paragraph to Statement 7 which appears just before the charts under Tab O.

In 1957, the companies served approximately 145,000 consumers and distributed over 83 billion cubic feet of gas, with a potential peak day demand this winter of 560 million cubic feet. You will notice those particular figures at the top of the columns on Statement 7. As will be indicated later, the companies anticipate that within thirty years their customers will require 268 billion cubic feet annually at a maximum daily rate of 1,650 million cubic feet. Those figures, again, are shown

at the foot of Statement 7 in the fourth and eighth columns. Are you able to locate those figures, sir?

THE CHAIRMAN: Yes, thank you.

MR. YORATH: Not only do these companies produce, transmit and distribute natural gas but they do all their own construction work. This has been the practice of these companies for many years; it has resulted in substantial savings to gas condumers in the province and is not a usual practice among gas utilities.

The companies would like at the outset to emphasize the fact that their business interests and the interests of the consumers of natural gas in Alberta coincide. Only by supplying the requirements of such consumers in adequate quantities and at the lowest possible prices can these interests be served.

It will be seen that this brief comprises matters of general information and policy as well as technical and economic matters. Questions on the former may be addressed to me. Questions on technical and economic matters may be addressed to Mr. B.F. Willson, the vice-president in charge of operations for the two companies.

Section II is the history of the companies. Canadian Western was incorporated under the laws of Alberta in 1911, under the name of Canadian Western

Natural Gas, Light, Heat and Power Company Limited and its name was changed in 1947 to Canadian Western Natural Gas Company Limited. The company distributes natural gas for domestic, commercial and industrial use in the southern part of the Province of Alberta, and serves a population of approximately 281,000; practically all of whom are dependent on natural gas for heating.

The company's area of service comprises the Cities of Calgary and Lethbridge and 49 other communities. Distribution is carried out under various franchises and by-laws of the respective communities or, in the case of unincorporated communities, under orders of the Board of Public Utility Commissioners for the Province of Alberta. Since the discovery in Alberta of natural gas in marketable quantities, the company and its associate, Northwestern, have been its leading distributors within the Province.

I would suggest, before I proceed with the reading of the narrative, that we turn to page 7 under Tab A. It is the coloured map at the back of Tab A.

Still referring to Canadian Western, the company's supply of natural gas is obtained principally by purchase from Madison Natural Gas Company Limited in the Turner Valley field and from Shell Oil Company of Canada Limited in the Jumping Pound field.

Natural gas produced in the Fenn Big

Valley and Stettler fields is purchased from the British American Oil Company Limited and provides a supply for the company's system between Red Deer and Calgary. Red Deer appears about halfway down the map showing the two companies' systems. Northwestern is in dark blue, and Canadian Western is in green. The company owns a small reserve field at Bow Island and Foremost upon which it draws to supply winter peak requirements of the system. The location of the various fields referred to above may be seen by reference to the map found on page 7 under Tab A.

Northwestern was incorporated in 1923 and is engaged in the business of the production, transmission and distribution of natural gas in Central Alberta. Its principal market is the City of Edmonton, but it serves in addition 56 other communities, including the Cities of Red Deer, Camrose and Wetaskiwin, and a large number of towns, villages and hamlets. The population of the area served by the company is 320,000, practically all of whom, as in the case of Canadian Western,depend on natural gas for heat. The location of the various communities served by this company may be seen by referring to the map found on page 7 under Tab A.

For many years the principal source of the company's gas supply was the Viking-Kinsella field, located approximately 80 miles southeast of Edmonton.

In recent years the company has undertaken exploration and development work in areas north and northeast of Edmonton and has established important reserves of dry gas which are of considerable assistance in meeting the maximum demand of the company's system. These newly developed reserves, together with gas from the Viking-Kinsella field are principally owned or controlled by the company. Since 1950, solution gas produced in conjunction with crude oil in the Edmonton area has become available in increasing quantities, and now supplies an important part of the company's market. Due to the fact that this gas is produced unavoidably with oil, the company as a conservation measure, to the fullest extent possible, gives priority to the purchasing and marketing of this solution gas.

The company has contracts to purchase oil-field gas from the Leduc, Bonnie Glen, Acheson and Samson fields located in the Edmonton area.

A drilling program in the Beaverhill Lake area 40 miles southeast of Edmonton, and adjacent to the company's four transmission lines from the Viking field resulted in the proving up of substantial reserves of dry, sweet natural gas. The company recently acquired 8,600 acres of proven gas reserves in the Westlock field, which is the field now known as the Picardville field and is shown on page 7 of Tab A north and west of the City of

Edmonton. On page 7 of Tab A the location of the various fields referred to above may be seen.

Section III deals with the growth of the systems. The growth of the systems can best be presented by referring to the six maps shown as pages 1 to 6 under Tab A. In these maps the systems as they existed in various years are set forth. The fields shown on these maps are the principal fields of interest to the companies which were known to exist in the various years noted.

Page 1 under Tab A illustrates Canadian Western system as it existed in 1913 with a line 170 miles in length and of 16-inch diameter, connecting the Bow Island field to Calgary, with branch lines serving the City of Lethbridge and other communities en route. It also shows the Town of Brooks served by a field immediately adjacent to that community. It will be noted that no pipeline system is shown in the area now served by Northwestern, which company was not in existence in 1913.

Page 2 under Tab A shows the Northwestern transmission line which was connected in 1923 comprising 78 miles of 10-inch and 12-inch diameter, connecting the Viking field to the City of Edmonton. The only change with respect to Canadian Western since 1913 was the construction of a six-inch line tying in the Turner Valley field at a point just south of Okotoks.

Page 3 under Tab A shows the changes that took place in the 10-year period 1923 to 1933. Referring to the Northwestern area the only significant transmission development was the commencement in 1929 of a second pipeline from the Viking field to Edmonton. This line,12 inches in diameter, had by 1933 reached a point near Ryley -- a point halfway to the City of Edmonton -- and was tied into the existing line at that point. It is impossible to show the lines connecting Ryley and Edmonton on that map, but the four lines are on that group as shown.

e B

The Canadian Western system was added to by the construction of two additional lines to Turner Valley, one of 10-inch and the other of 14-inch diameter. At the southeastern terminus of the Canadian Western system the map shows the connecting of the Foremost field to the company's main transmission system at Bow Island.

Now turning to page 4 under Tab A, it shows that in the ten years 1933 to 1943, the Northwestern system was extended from the Viking field southeast to the Kinsella field, the whole are now being considered as one field under the name of Viking-Kinsella. It also shows an extension from Northwestern's main transmission line to the Town of Vegreville. The second line previously referred to from Viking-Kinsella was continued from Ryley into Edmonton in 1943. In these ten years there was no change in the transmission line system of Canadian Western.

We now come to page 5 under Tab A, it shows that in the 10-year period preceding 1953 the growth of both companies was substantially accelerated. In Northwestern a line was extended to the City of Red Deer, serving it and communities en route. The Leduc-Woodbend field was connected to the system as were the fields of Fort Saskatchewan and Bon Accord. The company acquired the Vermilion distribution system which was served with inadequate

supplies from the Wildmere field. Because of the inadequacy of these supplies, Vermilion was connected to the Viking-Kinsella field. In addition, service was extended to other communities as shown on the map. During this period a third line from Viking to Edmonton was completed and about 40 miles of a fourth line built, both of these lines being of 16-inch diameter.

In Canadian Western, during this period, the Jumping Pound field west of Calgary was tied into the main transmission line south of Calgary by a 12-inch line, and service was extended westward from this field to serve a large cement plant at Exshaw, the Town of Banff and other communities en route. The main transmission system was looped south from the City of Calgary with a second 16-inch line as far as the junction of the 14-inch Turner Valley line and a cross-tie constructed from the 10-inch Turner Valley, shown in this group of lines a little south and west of Calgary. A well in the Princess-Brooks field, six miles northeast of Brooks, was tied in to the town system to reinforce the gas supply there. You will note there is a small line shown from the five graphs.

We come to page 6 under Tab A: Between 1954 and 1957, the Northwestern system was extended to serve various communities. An extension from Vermilion to Lloydminster was built to reinforce the

gas supply in the Lloydminster area. Looking at the map on page 6 and coming west, the next extension is from the Viking-Kinsella field to serve four communities immediately north. The next extension was a system built from the Beaverhill Lake field to serve five communities north of that area. You will note that particular line is not tied into our particular transmission system. A line was built west of the City of Edmonton to the Acheson field, connecting that field to the system and serving two communities west of Acheson. A 45-mile, 12-inch line was built from the Bonnie Glen field to the City of Edmonton to provide a market for oil-field gas. Service was extended to several communities west of Edmonton, as shown on the map. The company purchases the necessary gas supplies for these communities from a pipeline owned by North Canadian Oils Limited, which was built to serve the pukp mill at Hinton.

This completes the economic development of the Viking-Edmonton transmission system which is now geared to the optimum deliverability of the Viking-Kinsella field.

THE CHAIRMAN: Mr. Yorath, would you mind if I interrupted you for the moment? I would like to get through my head the distinction between looping a line and paralleling or building another line. Would you be the one to explain that to us?

MR. YORATH: Yes, Mr. Willson can add to that if I do not deal with it adequately.

In looping a line we loop a section to meet the deliverability. We may not parallel the complete line during any one year of construction. That is, we build a line, we tie that into the existing line of the market requirements. The building deliverability of the line is added to year by year.

THE CHAIRMAN: Does that increase the deliverability at the far end of the line, or just where the line is looped?

MR. YORATH: No, just at the far end of the line. Perhaps Mr. Willson could explain it further.

MR. WILLSON: Looping and paralleling, the examples you mention, sir, are pretty well synonymous. The building of a loop line or a parallel line and tying it in at some mid-point between the start and the finish of the line will increase the overall capacity of the system by increasing the pressure drop in the portion that is looped with the second line.

In other words, the pipeline's capacity can be increased by building a parallel line to it and tying it in mid-point of the terminals of the line.

THE CHAIRMAN: Then do you have to put in additional compressors?

MR. WILLSON: Not necessarily; the capacity of a pipeline can be increased by looping the pipeline or by putting in compressors and, in effect, increasing the pressure drop through the transmission system and in that way getting increased quantity of gas through the pipeline system.

THE CHAIRMAN: I am sorry, I just do not understand it. Surely, if you put more volume of gas through the main line, by way of looping, you must put in additional compressors to reduce or increase the pressure, whichever way you put it, that would give you a smaller volume under greater pressure; is that not so?

MR. WILLSON: In both cases we are talking about, we are assuming the source of supply is capable of supplying increased volumes.

THE CHAIRMAN: That is right.

MR. WILLSON: Without doing anything back at the start of the transmission system, the gas flows in a pipeline and the flow of gas is affected by three factors: principally, the length of the line, the diameter of the line and the pressure drop in the line, and by increasing the diameter you can get that increased volume, the length and pressure drop remaining constant or, conversely, you can increase the quantity flowing in the line by keeping the diameter and the length the same but by increasing the pressure drop by means of installing

compressors at the inlet end and creating a greater pressure drop over the length of the system and in that way the volume will be increased.

THE CHAIRMAN: Assuming your same diameter pipe and your same length pipe and assuming that you have full capacity, where is the advantage of looping unless you have further compressors to create this pressure drop?

MR. WILLSON: The effect of looping is to increase the diameter of the system. The second pipeline, paralleling the first one, effective increases the diameter of an entire system and, in that way, you get additional volume through the system.

THE CHAIRMAN: But, Mr. Yorath, if you have your full capacity going through your system and you have your loop that does not run the whole length of the system, and you have the same diameter pipeline, and you have it full to capacity, how do you get any additional gas at the far end of the line through looping unless you have further compressors in the pressure drop?

MR. WILLSON: The looping line -- let us take an example of a 100-mile line which is 12 inches in diameter, and it is operating at full capacity, and due to market growth it is necessary to increase the transmission capacity, and the economic studies are in favour of getting that increased capacity by building a looping line or parallel line.

The engineering computations will show the amount of looping line necessary in order to carry the increased volume required by the market growth. Once that computation has been made and the pipeline has been installed, let us assume that the computation indicates a 50-mile looping line is necessary, the increased volume is only in the first section, through two 12-inch lines, and the pressure drop over that first 50-mile section is, in fact, reduced because of the increased pipeline capacity. The second 50 miles, where we still have a single line, is able to carry more gas because it has a higher inlet pressure due to the construction of this looping line than it formerly had, and in that way the overall capacity of the system is increased even though the second line is not built all the way from the inlet of the transmission to the market. It is a fairly complicated matter, sir, and I am afraid I am not doing a very good job of explaining it.

MR. PATTILLO: Mr. Chairman, may I take a crack at it? Is not what you are trying to say this: if you have a single line running 100 miles, at a point 50 miles from the commencement of the line your pressure is down from what it was at the commencement of the 100 miles. Therefore, if you loop another line, starting at mileage one and running it to mileage 50 and tying in at the mileage

50 point, you now have two streams coming in rather than one, as formerly, and the pressure, therefore, at that point is increased considerably and, as a result, in the last 50 miles you can move much more gas in the same period of time as a result of those two funnels going in at that point.

Is that not the answer?

MR. WILLSON: That is correct.

THE CHAIRMAN: Thank you very much, Mr. Pattillo.

MR. YORATH: Mr. Pattillo should join our engineering staff.

Canadian Western extended its system south from the City of Red Deer to Airdrie, serving communities en route. It also extended its system south of the City of Lethbridge to serve six communities in that section of the Province.

I have already referred to page 7 under Tab A, which is a map showing the systems of the companies and their proposed pipeline construction for 1958, the most important of which are Northwestern's line from the Pembina field to Edmonton, Pembina being south and west of the City, and Canadian Western's line from Carbon field, north and east of the City, to Calgary.

Now, the growth of the companies is further shown by reference to the sales of the product and to the number of customers. I would refer

you to these particulars that are given on pages 1 and 2 of each of the Tabs B, C, D and E. These pages show the sales and number of customers year by year and selecting years, roughly ten years apart, under each of those tables, that may be tabulated as follows:

Canadian Western

Year	Customers	MCF Sales
1916	8,844	3,645,587
1923	11,752	1,915,683
1933	22,236	6,694,855
1943	26,926	10,828,386
1953	54,690	28,313,300
1957	73,624	37,601,442

We now come to Northwestern, which did not get into operation until 1923. Taking the year 1925, referring to Tab D and Tab E, we have:

Northwestern Utilities

Year	Customers	MCF Sales
1925	6,247	1,548,965
1933	10,478	2,745,546
1943	15,974	6,490,981
1953	55,698	25,711,569
1957	76,520	46,266,411

You will note tremendous expansion between the years 1943 and 1957 in both companies.

We will turn to Tab F and pages 1 and 2 under that tab show the gas consumption per capita of the two systems. The significant increase which has occurred indicates that the growth of system sales is attributable not only to the gain in population served by each system but also to a greater use of gas by individual users.

Mr. Chairman, do you wish to study those

charts a bit further? Shall I proceed?

THE CHAIRMAN: Yes.

MR. YORACH: You will note on page 1, dealing with Canadian Western, certain figures are not available because of the Dominion census.

Do you wish me to deal with Section IV?

MR. PATTILLO: I was going to say, Mr. Chairman, we should take that as read.

THE CHAIRMAN: I think we can take that as read.

MR. YORACH: Types of Gas: The natural gas obtained from the various fields referred to in Part II is of the following types:

(A) Dry, sweet gas -- This type is usually found at relatively shallow horizons and at relatively low pressure with the result that the wells are cheaper and in most cases the only processing required is the removal of sufficient water vapor to make the gas transportable.

(B) Sour and condensate field gas -- Sour gas contains sulphur compounds. Gas from the condensate fields is usually sour and also contains varying amounts of hydrocarbons which are recoverable from the gas as liquids. Gas in this category is usually found at greater depth and at higher pressures than dry, sweet gas, consequently the wells are more expensive and in order to make the gas marketable processing plants are required to

remove any sulphur or condensable hydrocarbons.

(c) Associated gas -- Associated gas falls into two categories:

(i) Gas which is in solution in the reservoir with the crude oil and which is produced with the oil at the time and place of the oil production itself, and

(ii) Gas which forms a gas cap overlying the oil reservoir.

Both types of associated gas have characteristics similar to condensate field gas. As a result, processing is required both to separate the gas from the oil and other hydrocarbons and also to remove sulphur from the gas.

Normally gas cap gas must be left in place until the oil reservoir is depleted to the maximum amount possible since it is the pressure of the gas cap on the oil column which provides the energy to produce the oil.

V. Gas Rates: The chart found on Page 2 under Tab G shows the Dominion Bureau of Statistics Consumer Price Index over the period 1939 to 1957 as compared with the average domestic gas prices over that period for the two systems.

The chart shows that the average domestic prices have remained relatively stable during a period when consumer prices have risen over 90 per cent.

The rate history of the companies upon which the chart just referred to is based will be found on Pages 1 and 2 under Tabs H and I for Canadian Western and on Pages 1 and 2 under Tabs J and K for Northwestern.

The current rate schedules prevailing in the two companies are shown under Tabs L and M.

The present policy of Canadian Western and Northwestern with respect to gas rates is a "cost of service" approach consistent with the formula for allowable revenues adopted by the Board of Public Utility Commissioners of Alberta. It is of course recognized that there are other valid approaches to the determination of rates, depending on such varying circumstances as the price of competitive fuels and the consumer's ability to pay. However, the companies have been for many years in a somewhat unique position in that their rates for the greater part of the service area have been well below comparable prices of competitive fuels. This is due to the proximity of markets to sources of gas supply and to the construction of major portions of the present production, transmission and distribution facilities at cost levels substantially below those of the present day. This also accounts for the fact that gas rates in the major portions of the companies' systems are the lowest on the continent, with only one or two minor exceptions.

Costs on the companies' systems are determined for various classifications of service depending upon volume of annual use and the relationship between average daily use over the year and peak day demand, that is load factor. This is accomplished by means of a detailed cost analysis from which an appropriate portion of each element of cost in the board's formula for allowable revenue is allocated to each classification. Rates are then set to yield revenues equal to the total of such costs as closely as practicable.

In the period of rapidly rising costs, during the subsequent to World War II, service has been extended by the companies to a large number of additional communities. In these cases, because of such increased costs, rates in effect on the original systems would not have yielded the costs of service for the required facilities. Higher rates have therefore been established and a cost of service approach has been made in setting such rates.

In the higher rate areas served by the companies, gas rates are closely competitive with comparable coal prices and in certain cases exceed them somewhat although still well below the comparable prices of fuel oil or propane. Nevertheless, almost the entire potential market has been obtained due to other advantages of natural gas as a fuel. Some of these advantages are cleanliness, ease of

control, lower equipment maintenance and the avoidance of fuel and ash handling.

VI. Load Factor: To appreciate fully the role played by the various types of gas supply mentioned under Section IV and the importance of each in combining to serve a particular market, it is necessary at this time to go into the matter of load factor.

Since gas cannot be stored on consumers' premises and yet must be available when needed, it is necessary that the utility provide production, transmission and distribution facilities of sufficient capacity to supply the maximum coincident demand (peak demand) of all its customers. In Alberta, it has been found that the maximum potential daily demand is reached when the average temperature falls to 40 degrees below zero, or lower. Since weather of this severity occurs infrequently it follows that the companies' facilities are used to capacity on only rare occasions. The average daily throughput during the year is of course much less than that which is handled on the severe day referred to above. The relationship between the average daily quantity consumed throughout the year and the maximum potential daily demand for that year is referred to as the annual load factor of the companies' systems.

Before I deal with the next paragraph,

I wonder if you would turn to Tab N and the chart under it, and I am afraid I must apologize in that there is an error in the preparation of this chart and also the formula at the bottom of the paragraph on page 13. The theoretical peak for the winter of 1956/57 should be 294 and not 321. So that on the chart, at the top of the page, 321 should be changed to 294, and at the bottom of the chart the same figure should be substituted. That also applies to the formula at the bottom of the paragraph on page 13.

THE CHAIRMAN: This is Tab N?

MR. YORACH: Tab N, yes. With the substitution of 294 for 321, that results in the load factor being changed from 38.5 per cent to 42 per cent.

With those corrections shall I proceed?

THE CHAIRMAN: Thank you very much.

MR. YORACH: On the graph under Tab N the daily sales of gas by Northwestern are plotted for the year 1957. Northwestern is shown as an illustration of load factor. It will be noted that on February 21 the daily sales were at a maximum and amounted to 257 million cubic feet, while on August 18 the daily sales fell to 48 million cubic feet. It will also be noted that the daily sales vary widely throughout the year. The horizontal line represents the average sales per day throughout the year which was 123.5 million cubic feet. The

annual load factor of Northwestern during 1957 was therefore $\frac{123.5 \text{ (average daily sales)}}{257 \text{ (peak day sales)}} \times 100$ = 48%.

It should be pointed out that during this year the coldest day had an average temperature of only 15 degrees below zero. The peak would have been much higher than the 257 million cubic feet above referred to had more severe weather conditions been encountered. The utility has to plan for the worst conditions even though they do not materialize in any one year. The potential peak day demand on Northwestern's system in 1957 was 294 million cubic feet and if that demand had been incurred the load factor would have been $\frac{123.5 \text{ (average daily sales)}}{294 \text{ (peak day sales)}}$ x 100 = 42%.

The capital investment of a utility is very high relative to its annual gross income. Fixed charges represent a large portion of its annual fixed costs and since those annual fixed costs must be spread over the amount of gas sold during the year the fixed costs per unit will vary inversely with the load factor. For example, if a processing plant designed to deliver 100 Mcf of gas per day is operated at 100 per cent load factor it will deliver 36,500 Mcf in a year. If, on the other hand, it is operated at only 40 per cent load factor it will deliver only 14,600 Mcf during the year. In the first case, the fixed charges are

spread over 36,500 Mcf and in the latter they can be spread over only 14,600 Mcf resulting in unit fixed costs two and a half times as great as in the case of 100 per cent load factor. The same principles apply to the costs of transmission and distribution.

A very large percentage of the natural gas consumed in Alberta is used for space heating. Consequently, the demand varies inversely with the temperature. In Alberta there is a very large variation in the daily temperature throughout the year. The graph under Tab N illustrates how frequently and extensively the demand varies over the year.

I might say it shows one of the major headaches in the natural gas utility business.

This low load factor pattern will continue as the local market grows unless such growth is accompanied by a greater proportion of industrial sales and possibly a marked increase in the use of gas for summer air conditioning. If the proportion of industrial sales (which vary only slightly with temperature) decreases, the load factor will worsen.

Frequent sharp variations in peak demand can be best handled by dry, sweet gas fields, the production from which is flexible. Their production can be adjusted much more easily and

quickly than the output of a processing plant. While the peak demands are large they are usually of short duration so that the annual amount of gas required to handle them is small.

Consequently, the load factor on such a field is very low. Again, dry, sweet gas sources are most desirable to meet these peak demands because the investment is relatively low and the effect of poor load factor on unit costs is minimized.

If suitable reservoirs are available gas can be taken from the less flexible sources during the summer time and injected into these reservoirs for reproduction during periods of peak demand. For this purpose, dry, sweet gas fields which have been partially depleted are the most suitable. If dry, sweet gas is reinjected into a reservoir which has contained sour gas and other hydrocarbons, it becomes contaminated by the residual impurities left in the reservoir and has to be repurified when reproduced.

In most instances, heating or processing equipment of large customers, more particularly industrial consumers, can be equipped to burn either gas or oil. Where this is the case, a rapid switch-over from one fuel to the other can be made and oil used during periods when there is a large demand for gas. This is known as peak shaving and is common practice in certain localities where the cost of oil is not substantially higher than gas so that the cost of gas plus oil is still more economical than oil alone or any other fuel.

Where this practice prevails, gas service is provided to such customers at lower rates than that provided to firm customers. This special type of service is known as interruptible, that is to say, in periods of peak demand the supply to such customers may be curtailed or discontinued.

However, in Alberta, oil is considerably more expensive than gas and if a customer were asked to switch to oil for any length of time the cost of gas plus oil could exceed the cost of using coal. Consequently, this particular method is not very practical in Alberta.

Peak load sources and summer storage do not improve the load factor of the market. However, they do improve the load factor which can be offered to fields with a high investment where a high load factor is essential to economic operation. They concentrate the impact of poor load factor on the peak load sources where it has the least effect on total costs. If a suitable storage reservoir can be obtained close to the market it also improves the load factor on the transmission lines.

Now we come to Section VII, dealing with present supply and plans for immediate future.

While the Canadian Western system is presently connected to reserves of sufficient size to supply base load requirements for 20 years at

the present rate of annual consumption, a new source of peak gas must be obtained immediately.

I would refer you now to Tab O, which I referred to in my earlier remarks. If you wish, I could read the narrative under this tab. It, in itself, is largely statistical and, I presume, would be the subject of questions later on, should anyone wish to ask them.

THE CHAIRMAN: I do not think you need to read it, Mr. Yorach. We have it here.

MR. YORACH: Statement 3 under Tab O shows the estimated future peak day requirements and annual sales until 1986. On the basis of these estimates, the peak day demand will exceed the maximum deliverability of the presently connected sources by the winter of 1958-59. To take care of this situation the company plans to connect during 1958 the Carbon field located about 50 miles northeast of Calgary. This is a dry, sweet gas field with higher deliverability and will be used to supply peak loads. Eventually it will be used for storage as well.

Mr. Chairman, with your permission, would it be agreeable to you if I asked Mr. Willson to expand on that point, for a minute or two?

THE CHAIRMAN: Certainly.

MR. WILLSON: Mr. Chairman, on Friday, the witness for the City of Calgary gave certain

cost data relative to the companies' Carbon project and we found it was important to correct what I think was a misstatement as to the impact of the Carbon project on the cost of gas to Canadian Western customers.

The situation is, roughly, as follows: the capital cost of the Carbon project is estimated at 9½ million dollars and the annual fixed and operating costs will be in the neighbourhood of $1,400,000. The company's sales in 1959, the first full year of operation after the project has been built, are estimated to be about 40 billion cubic feet, so the cost per Mcf associated with this particular project will be of the order of 3½ cents rather than the 8 cents that was mentioned on Friday.

We would also like to point out that this is the worst month which could be taken for the cost of the Carbon project. Under our Utility Board regulation, the company's plant is depreciated at an annual rate of 3 per cent and, 15 years down the road, say, the value of the Carbon plant in the company's books will be only 55 per cent of the initial cost and the annual fixed and operating costs will be of the order of $850,000.

Assuming that the company's sales are, as in the year 1974, 15 years hence, 81.5 billion cubic feet estimated in the material under Tab O, the unit cost per Mcf will be fractionally over one cent

per Mcf.

We thought it was important to make that explanation with respect to this particular project.

THE CHAIRMAN: Thank you, Mr. Willson.

MR. YAROCH: Now, carrying on with page 17: In addition to obtaining additional gas to supply peak loads, the company must look ahead and plan for additional substantial reserves for future use. It is anticipated that a processing plant will be completed in the Okotoks field early in 1959 and that the residue gas from this plant will be used to help meet growing demands. Canadian Western's market is continuing to develop but unfortunately the load factor is not improving. For this reason, it is imperative that a peaking source such as Carbon be connected. As a further indication of the flexibility of dry, sweet gas sources, it may be pointed out that, if necessary,by taking from that field more gas than is actually required for peaking, the company will be able to meet its market requirements until sufficient base load has been developed to warrant the construction of a purification plant at one of the sour fields. If this is done, the additional gas taken out of Carbon can be replaced by repressuring during summer months.

We now come to Northwestern, sir, and their requirements are also shown under Tab O ---

THE CHAIRMAN: Tab O or Tab P?

MR. YAROCH: Their requirements are shown under Tab O, sir, and I give that as a note to bring it to the attention of the Commission.

I will deal with Tab P now. If you will look at page 3 of Tab P, at the bottom of it you will note that of Northwestern reserves, 31.4 per cent come from dry sweet gas fields, whereas, if you turn back to page 2 of Tab P, you will see that at the present time, of Canadian Western's reserves, there are only 5.2 per cent of them connected to dry gas fields and, even after the connection of Carbon, there will be only 22.9 per cent.

Northwestern's system is presently connected to substantial dry, sweet gas fields which are capable of meeting peak demands for the next few years. (See Tab P, page 3). However, these dry, sweet gas fields are being used to supply a large amount of base load gas (this is in the case of Northwestern), causing their pressure to decline and their deliverability to diminish. It is therefore necessary for Northwestern to gain access to large base load reserves and thus enable it to preserve the deliverability of the dry, sweet gas fields for peaking purposes. Northwestern plans to build during 1958 a transmission line to the Pembina oil field located about 70 miles west of Edmonton and take delivery of residue gas estimated to amount to 65 million cubic feet per day. As

much Pembina gas as possible will be sold to Northwestern's customers and the balance stored in the Viking-Kinsella gas reservoir. In view of the importance of adequate dry, sweet gas sources serving a low load factor market, N rthwestern last year purchased a substantial interest in the Westlock gas field some 50 miles northwest of Edmonton.

We now come to Section VIII, onpage 19, The Broblem of Alberta's Long Term Supply and Cost of Gas.

The major problem confronting the companies today is that of ensuring adequate future supplies of natural gas at prices or costs which have a minimum financial impact on consumers. This is a difficult problem because of the low load factor of their demands and the necessity of maintaining deliverability for the future. It must be solved within a framework which takes into account the following factors:

(a) The necessity to keep the retain rates for natural gas as low as possible in order to compete successfully with other low-cost fuels, principally coal.

(b) A recognition of Alberta's present difficulty in attracting industry and the desirability of retaining for the province the advantage of low cost gas supplies.

(c) The low annual load factor of the Alberta

utility market and hence the necessity of the companies themselves developing their own sources of peaking gas.

(d) The high unit cost of peak load gas resulting from its production on such a low load factor.

(e) The very sizeable future gas requirements and the relatively small present market over which to spread present day costs associated with meeting these future requirements.

(f) The necessity of paying a price for natural gas which enables the producer to recover his costs, including a reasonable return on his capital investment.

(g) The importance to the economy of the province of a healthy oil and gas exploration and producing industry and the need for reasonable incentives to maintain it.

(h) A recognition that local markets for natural gas are limited at the present time, and that export from the Province is necessary in order to provide adequate market outlets.

(i) The likelihood that the ultimate proven reserves of Alberta will be at least the 75 trillion cubic feet postulated by the Oil and Gas Conservation Board in its report of January 31st, 1957.

It is within the framework of these factors that the Alberta utility companies have sought to solve the problem of ensuring the future gas

requirements of the province at prices no higher than are necessary to provide the required volumes of gas. Possibly an elaboration on each of these factors would be helpful to the Commission in its understanding of the local situation.

(a) The Effect of Competitive Fuel Prices on the Future Demand for Natural Gas: Under Tab R is a report prepared by the Stanford Research Institute of Menlo Park, California, at the request of Northwestern and Canadian Western. The companies have been concerned for some time lest rising field prices of natural gas, coupled with other increases in costs, result in natural gas losing its place as the lowest cost fuel for industry in the province. At the present time, industrial natural gas rates are such that in most locations gas undersells coal and other fuels.

With this competitor fuel problem in mind, the companies retained the Institute to prepare an estimate of the future demand for natural gas in the Province and to assess the impact of this demand on industrial growth. The report was completed in August of 1957. Distribution has not been widespread to date. I ask you to turn to page 12 under Tab R.

MR. FRAWLEY: Mr. Yorath, when you say "distribution has not been widespread", you mean the distribution of this report?

MR. YORATH: Of this report, sir.

MR. FRAWLEY: Yes, thank you.

MR. YORATH: The report looks into the future as far as 1970. It estimates the demand for natural gas in the market area of the two utility companies for the year 1970 to be 172.4 billion cubic feet, and you will note that is the second figure in the right hand column of the table. This is slightly less than the companies' estimates for the same year of 177.7 billion cubic feet. This is pointed out and referred to in Statement 7 under Tab O. Statement 7 is the last statement under Tab O before the charts. It is a statement which was not included in the copy prepared for the Conservation Board. It is one which was prepared at my suggestion to compare the statistics of the two companies for the purpose of this hearing.

The Conservation Board in its estimates of the future provincial gas requirements has prepared them on a province-wide basis rather than on that of the areas served by the two companies. The Institute's estimate for the total provincial requirements for the year 1970 is 222 billion cubic feet as compared with the Board's estimate of 257 billion cubic feet.

Broadly speaking, the Institute has estimated the provincial domestic and commercial requirements at somewhat higher levels than the Conservation Board and the companies, due to larger estimates of population growth. However, its estimate of gas for industrial use is substantially less than those of the Board and the companies. The reasoning behind their estimates is set out in the report. It would appear that one of the major reasons for the substantially lower estimates for industrial use lies in the consideration given in the Report to the competitive fuel situation.

Mr. Chairman, a representative of the Institute is available to be called as a witness. I would like to suggest, if convenient to you, sir, that after the completion of our narrative Mr. Trexel might be requested to discuss the Stanford Research Institute's report. He has come up here from California and does not want to be around in this climate any longer than he can help.

The companies in formulating their policy for long-range supply have had to keep in mind the fact that coal from Alberta's vast reserves can be delivered to industrial markets in some instances at prices equivalent to natural gas at 12¢ per Mcf. Since it appears likely that in the future gas cannot be developed, gathered and processed for less than 12¢ per Mcf, it follows that in certain cases at least coal will supplant natural gas. The threat of competition from other fuels causes a great deal of concern to the companies in that if they are to lose their industrial markets, the fair share of system costs presently borne by industrial consumers will have to be carried by the domestic and commercial users and this can only result in further increases in domestic and commercial gas rates.

Attracting industry to Alberta: Alberta with its relatively small local markets and the distance it is located from the larger national markets, needs every advantage it can obtain in order to attract new industry and thus stabilize the economic base of the Province. One advantage it has had to date has been low industrial gas rates. This has been due largely to the development of shallow gas supplies at cost levels considerably below those of today. Present high cost levels will of necessity result in increased

industrial gas rates. In order to attract industry to Alberta it is necessary to keep industrial gas rates as low as possible.

The low annual load factor of Alberta markets: As is shown in the 30-year projection of market requirements (Statements 3 and 6 under Tab O), the annual load factor of the companies' markets is about 40%. Because supplies from oilfield operations and condensate fields are purchased at load factors of 70% and higher, it is necessary to provide peaking facilities to transform the total supply to a 40% load factor pattern. As a result these peaking facilities have to operate on load factors of 20% and less. Since this is not an attractive type of market to a gas producer, the companies have found it necessary to develop these facilities themselves.

Cost of peak load gas: Because of the low annual use made of peaking facilities, the total costs, both fixed and operating, must be spread over a small number of units. This can result in very high unit production costs. In determining its policy with respect to acquiring additional supplies, the companies must keep in mind the burden of costs associated with peak load facilities.

That statement is supported by Tab Q. I understand, Mr. Pattillo, you suggest I should read Tab Q?

MR. PATTILLO: If you would, please.

MR. YORATH: Northwestern Utilities, Limited: Economics of production from the Viking-Kinsella field -- which is used as an example. The largest gasfield owned by the companies is Northwestern's Viking-Kinsella field. This field was discovered in 1914 but was not connected to a market until 1923. Development has taken place continuously from that time until the present. Northwestern Utilities owns or controls the greater part of this field -- approximately 469 square miles, and there are 88 wells tied into the gathering system, an average of one well per 5.3 square miles. The production formation is a relatively thin sand in the Viking Formation, of Lower Cretaceous age, found at a depth averaging 2,000 feet. The field is of relatively good porosity and 10-day stabilized open flows of the wells average 5.2 million cubic feet per day, ranging up to 11 million. Reserves owned or controlled by the companies as at January 1st, 1958 total 378 billion cubic feet with an average shut-in pressure in October, 1957 of 540 psig. The gas is sweet, contains negligible amounts of condensate hydrocarbons and requires only dehydration before delivery to market.

The total investment in the field as at December 31st, 1956 was as follows:

Gas Wells	$1,913,680
Leaseholds and Gas Rights	3,182,987
Gathering System, including dehydration, metering and regulating equipment	3,427,525
Structures	413,008
Miscellaneous	105,463
	$9,420,663

The investment, both for acquisition of leases and gas rights and for physical plant would be very substantially higher at present day cost levels.

An indication of the approximate producing cost per Mcf is given by the following:

Assumptions re Fixed Charges

Return -- 7.5% on total investment, ignoring accrued depreciation.

(Note: It is obvious that the company's overall allowable rate of return of 7.5% is not appropriate to the higher risk production part of its operations. Since there is no established precedent governing this, accrued depreciation has been ignored as some offset to a more appropriate higher rate of return)

Annual Depreciation -- 3.5%

Income Taxes -- 2.5% (Consistent with 1956 experience for the system reflecting depletion allowance and drilling credits)

Annual Costs - 1956

Total Fixed Charges- 13.0% on \$9,042,663 =	\$1,175,546
(I should add in here that the company's 1956 production amounted to 19,611,591 MCF)	
Operation and Maintenance Expense (Calculated share of total system production expense)	583,646
Total Annual Costs, exclusive of administration and overhead expense	\$1,759,192

... Production cost per MCF = 8.97¢

Effect of Load Factor: The calculated maximum deliverability of the field at the end of 1956 was 150 million cubic feet. Average daily production during the year was 53.7 million cubic feet. Hence, the field operated at 36% load factor. If production had been taken at higher load factor, unit cost would have been much lower since the only significant increase in cost would have been royalties. For example, at 50% load factor, unit production cost would have been 6.6¢ per Mcf and at 75% load factor, 4.6¢ per Mcf. On the other hand, if the field had been operated solely for peaking purposes with an annual production of, say, 2,000,000 Mcf, unit costs would have been 82.7¢ per Mcf. This figure in a relatively low cost field such as this gives some measure of the extremely high cost which would be associated with peak

load gas if this were developed from condensate fields or oilfields where expensive processing facilities would be required.

Mr. Chairman, I wonder if I might again ask Mr. Willson if he would elaborate on this whole matter of load factor.

THE CHAIRMAN: The whole matter of what?

MR. YORATH: L ad factor.

THE CHAIRMAN: Yes. I want to make sure, gentlemen, that we do not get into a situation where we are dealing with matters which only affect a rate construction as between the City and the Unilities because the Commission is, in fact, not concerned with that. We are concerned with your estimates of reserves of gas, and all that sort of thing, which has a bearing on the responsibility imposed on us by the terms of reference. I want your help -- the help of yourself and Mr. Helman and Mr. Pattillo -- so that we do not sit here and listen to evidence that is primarily relative to the City of Calgary and the utilities themselves as distinct from the wider problem.

Mr. Pattillo, we have asked you to help us in that respect, and you know the sort of questions which you desire to ask of the people submitting the briefs, so I will leave that for the moment in your hands, but I do emphasize that we have a relatively short period of time for the hearings

and a great deal of work to do, and each day is filled, and I do not want to get into evidence which goes just back and forth on a rate basis.

MR. PATTILLO: I understand, Mr. Chairman. The reason I asked Mr. Yorath to deal with this peak load problem is that I do think it has a great deal to do with the question of what quantities of reserves there are, and what portions of the reserves are going to be required for provincial use and for other Canadian use. When we are dealing with the question of export to the United States I think that is a very important part of the matter which we have got to clearly understand.

THE CHAIRMAN: Very well.

MR. YORATH: I can assure you, sir, that we have no desire at all to have our rate application heard before your Commission.

THE CHAIRMAN: I am sure nobody has any such desire.

MR. STEER: I would be glad to have it heard.

THE CHAIRMAN: Well, it is mutual -- let us put it that way. Mr. Willson, I see Mr. Pattillo's point, so will you continue, please?

MR. WILLSON: Mr. Chairman, this further point does relate to the matter which you have just brought up, namely, it is not your Commission's

duty to inquire into differences of opinion between the City of Calgary and the company with respect to the supply of gas for the City of Calgary. The thing that concerned us somewhat was that possibly the Commission on Friday was left with the impression that the cost of gas from the producer's point of view did not vary with the load factor of the market.

There were two points that concerned us: one, that the impression might have been given that the load factor of the market did not affect the cost but only the absolute volume of sales and we hope to try and point out to the Commission the effect of the low factor on costs of production. The second point dealt with the discussion of the provision in the contract between the company and Alberta and Southern as to the remedy to the provision of peak gas of 1.3 times the weighted average field price. I think, again, the impression was given that that was a provision which worked a burden on any consumer who might be considered as an ultimate consumer of gas supplied under such an arrangement and we thought we should try to point out to the Commission the very favourable arrangement which is the 1.3 provision is strictly for peak load gas. With your permission I would like to go into that just for a moment.

THE CHAIRMAN: Certainly.

MR. WILLSON: I think one statement was made that if that company did, in fact, buy gas from Alberta and Southern, assuming that Alberta and Southern gets its permit and complete its facilities, that if the company decided that its most economical source of supply was from Alberta and Southern and that the load factor of the company's requirements were 68 per cent that the company would be required to pay for the entire supply at 1.3 times the

weighted average field price.

THE CHAIRMAN: Or replace it with an equivalent amount of gas.

MR. WILLSON: Or replace it with an equivalent amount of gas. In this matter of load factor, it is necessary to understand the nature of the market of the various factors relative to the demands of the consumers and, under such circumstances, as was postulated, the 68 per cent load factor, the company would be able to schedule at least 95 per cent of its total requirements on a 70 per cent load factor basis which would leave something less than 5 per cent as scheduled as strictly peak load gas and the 1.3 provision would apply to that similar amount and the overall price paid by the company, under those circumstances, would only be fractionally above the weighted average field price of Alberta and Southern and the 1.3 price would not apply to the entire volume as was suggested to be the case on Friday.

MR. HELMAN: Until you get down to the 35 per cent load factor for Calgary.

MR. WILLSON: Under the contract we would probably buy peak load gas at one or two per cent of peak load factor as demonstrated under Q and the cost of that gas produced is in the order of 80 cents and the company would be able to buy peaking gas for 1.3 over that price. Assuming the

price is 15 cents the company would be able to buy peak load gas at 19 cents. That gas would cost the company substantially more to develop from its own sources. We just wanted to make that point in connection with that contract provision, Mr. Chairman.

THE CHAIRMAN: Thank you.

MR. YORACH: Mr. Chairman, continuing with (e) A Large Future Market Compared with a Relatively Small Present Market: It has been suggested that the companies should acquire sufficient gas in the ground at this time to take care of their long-term requirements. The estimated recoverable reserves of fields presently connected to the transmission lines are slightly over 3 trillion cubic feet. As noted in Statement 7, to which I have already referred, under Tab O the companies estimate their 30-year market requirements to be about 5.4 trillion cubic feet. In order to ensure deliverability in the thirtieth year, another 1.5 trillion cubic feet undoubtedly would be necessary. Therefore, to have under control sufficient proven reserves to take care of the 30-year requirements, the companies would have to acquire <u>today</u> an additional 4 trillion cubic feet.

Assuming this gas could be acquired at 2.5 cents per Mcf in the ground, an immediate expenditure of about $100 million would have to be made. Since the fixed charges on this investment would have to be borne by present day consumers, it

has been calculated that even if the project were financially feasible, existing rates would have to be increased by more than 60 per cent just to take care of the annual costs associated with an expenditure of this magnitude. If supplies are acquired from time to time as required in the future and as justified by market growth, then the impact at any particular time will be much less.

THE CHAIRMAN: Would it be satisfactory to break here for ten minutes?

---A short recess.

MR. YORACH: (f) Price to Producers: It is clear that the gas producing industry will not explore for and develop the province's gas reserves unless an adequate financial return will be realized. The history of the industry in this province has demonstrated that the money required for the development of gas reserves must compete with the crude oil side of the industry and it is logical that oil companies will not spend the many millions of dollars necessary to develop natural gas reserves unless the return is reasonably comparable to that which would be

earned by those same dollars spent in the development of crude oil. Since the purchasing power of the dollar is much less today than it was ten years ago, it follows that the costs of acquiring land, exploration and development, are such today that the unit selling price for pipe line gas must be higher than prices which were fixed in the 1940's and early 1950's. Canadian Western pays 10 3/4 cents per Mcf for gas purchased from the Turner Valley and Jumping Pound fields. These prices were fixed in 1948 and 1951 respectively. It is not likely that Canadian Western will be able to contract for comparable supplies developed under 1958 cost levels at the same price as in its Turner Valley and Jumping Pound contracts.

The possibility exists that if gas prices were such that the returns to the gas producer were comparable to those of the crude oil producer then greater effort would go into the exploration and development of natural gas reserves. A more intensive exploration program for gas only should have the result of proving up substantially larger reserves than would result from a program geared to a less intensive exploration activity. Assuming the demand for natural gas is the same in both cases, an increase in available supplies should result in greater long term stability of price than would result from bargaining in the future for

gas in shorter supply.

The next paragraph is (g), The Necessity to Meet the Problem Without Confiscating the Capital of Others: It has also been suggested that the provincial authorities be asked to set aside and immobilize certain proven reserves in order to be sure that the 30-year requirements of the province are taken care of before additional export is permitted. This presumably would involve the arbitrary selection of certain fields. The owners of those fields would have to be told that they could not offer their gas to potential purchasers, but rather that their reserves would have to be shut in for use at some indefinite future time to be used within the province. This would amount to confiscation of capital.

The dangers inherent in such a situation are obvious. The companies do not consider this to be a reasonable or proper way of providing for the future gas requirements of the province. This country has progressed under a free enterprise system whereby resources have been developed and marketed (provided that proper conservation is achieved) under the natural economic laws of supply and demand. Any artificial barrier to this policy would not appear to be in the best interests of Alberta and Canada. If the future development of our gas resources is to be encouraged, a proper

framework of government policy must be followed.

(h), The Necessity of Export Pipe Lines to Market the Gas Potential of the Province: As a result of exploration and development work done to date, the proven gas reserves of the province are considered to be at least 20 trillion cubic feet. If these reserves are to be developed within the foreseeable future, markets outside the province are essential because of the fact that Alberta markets are just not large enough. The alternative to export pipe lines is to retard the development of gas reserves until the are needed for use within provincial boundaries. Such a policy would restrict the inflow of capital into Alberta and Canada and as a result the economy of the province and the country would be retarded significantly.

It seems inevitable that if we wish to have our gas resources developed, we must also have export of gas in sizeable volumes.

(i) The Potential Reserves of the Province: The Conservation Board in its report of January 31, 1957, estimated that the potential reserves of the province are of the order of 75 trillion cubic feet. This estimate was made by applying to the existing proven reserves the ratio between the total volume of sedimentary rock known to exist and that volume thereof explored to date. Other individuals or bodies have estimated the potential recoverable

reserves at figures substantially higher than the 75 trillion cubic feet suggested by the Conservation Board. Assuming that the Board's estimate is a reasonable one, it would appear that substantial quantities of gas could be exported from the province without the local supply being endangered.

We now come to Chapter IX, The Companies' Plan for Solving The Problem of Future Supplies: As a result of their assessment and consideration of the various factors outlined above, the companies have rejected as unsuitable certain methods for ensuring future supplies for consumption within the province. Essentially, the idea of buying sufficient gas today to look after the 30-year requirements has been rejected because such a plan is far too expensive and the impact it would have on present day gas rates would be drastic. Moreover, the companies have rejected the idea of asking for an arbitrary allocation of reserves on the grounds that an unnatural device of this type is not consistent with our free enterprise system and would undoubtedly be unfair to certain producers.

At this point, sir, I might say that we had considered entering into a discussion regarding a misconception as to the Sarcee field which we felt was developed on Friday, but in view of your remarks that it was a local situation and has no place here, we shall not do so.

As an alternative, the companies feel that Alberta's future requirements can best be protected by giving provincial requirements first call on all provincial gas not already committed to export. This protection can be assured by the Government of the Province adopting the principles:

(i) that on every occasion when an export permit is being considered, the proposed exporter shall establish that in addition to any quantities the export of which is requested there is a sufficient supply to meet the requirements of the distributors for a rolling period of not less than 30 years.

MR. HELMAN: May I ask what is meant by "rolling"?

MR. YAROCH: By "rolling" we mean that at any time when an application is made for a new permit to export gas or to increase the existing permit the 30-year supply should be from that date.

MR. HELMAN: That is the present policy, is it not?

MR. FRAWLEY: I understand that is the present policy of the Conservation Board.

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(ii) that the proposed exporter shall establish that such gas is available to the distributors at prices not in excess of that paid by the exporters and just as economically accessible to the distributors as the gas the export of which is in question.

(iii) That pipeline systems used for the export of gas should be available for the transport of gas to the provincial distributors on terms not more onerous than the terms on which the export gas is carried.

Assuming that gas in sufficient quantities is available for export, an agreement, which in effect embodies the foregoing, has already been entered into between these companies and Alberta and Southern Gas Co. Ltd.

This plan has many advantages:

(i) It permits the present development of the gas resources of the Province.

(ii) It allows producers to seek market outlets.

(iii) It avoids the necessity for the expenditure by Alberta utility companies of the many millions of dollars that would be necessary in order to buy sufficient gas in the ground to look after the 30-year requirements of the Province from time to time.

(iv) By combining gas for local use with that being delivered to export pipelines, the economies inherent in large scale production and transmission are possible. They could not be realized if the quantities produced were restricted to those necessary to meet local market requirements only.

I would like to refer you, sir, to Tab S. I have a notation here to read the first page of that tab, if you wish me to do so. I will abide by your decision, sir.

THE CHAIRMAN: Well, yes, I think it would be interesting to have that read, Mr. Yorath.

MR. YORATH: Page 1 of Tab F: Two studies of the cost of transporting gas by pipelines are presented on the following pages 2, 3 and 4. The first is given on pages 2 and 3 and deals with long-distance transportation at 780 pounds maximum operating pressure, involving the use of compressors to boost pressure en route. The second is given on page 4 and deals with the costs involved in pipelines of 100-mile length, operating at a maximum pressure of 500 pounds without compressors, it being assumed that these pipelines are constructed by the companies.

The purpose of these studies is to show the economies possible by the use of high pressure,

large diameter pipelines operating at high load factor. The first study assumes that the design and construction of the pipeline and compressor facilities are carried out by consultants and contractors retained or employed for such purposes. Consequently the capital costs reflect the profits which are appropriate to these functions and the administrative and overhead costs associated therewith. The second assumes that the facilities are incorporated in the companies' utility rate base at "out-of-pocket" cost, exclusive of engineering and administrative costs, since these are incurred in any event in other normal utility operations.

The last tabulation on page 3 shows, for the first case, that the annual unit cost per 100 miles varies from less than 2¢ per Mcf for a 36-inch pipeline operating at 100% load factor to about 7¢ per Mcf for a 20-inch pipeline operating at 50% load factor.

On page 4, the annual unit cost for a 100-mile pipeline constructed by these companies is shown to vary from 1¢ per Mcf in the case of a 30-inch pipeline operating at 100% load factor to more than 60¢ per Mcf in the case of a 4-inch pipeline operating at 40% load factor.

It is important to note that large quantities of gas can be transported 2,000 miles through a 36-inch pipeline, operating at 100%

load factor, at lower cost per Mcf (20 x 1.77¢ = 35.4¢) than small quantities transported for 100 miles through a 4-inch pipeline at 40% load factor (61.4¢), even though the economies inherent to construction by utility companies are reflected in the latter case. This explains why residents of some small communities in Alberta cannot be served, particularly where gas has to compete with low cost local coal supplies, while it is economically feasible to supply residents in Eastern Canada with Alberta gas.

Going back to page 30 of the brief:

In order to further this plan, Canadian Western and Northwestern have, as already pointed out, entered into a contract with a proposed gas export company (Alberta and Southern Gas Co. Ltd.) under which the requirements of the companies' customers are given priority over those of the export market. A copy of this contract is attached under Tab T.

I don't think you would wish me to read that contract, but I wonder if it would be of assistance to the Commission if I asked Mr. Willson to analyze and summarize it?

THE CHAIRMAN: Yes, we should like to have that done, Mr. Yorath.

MR. WILLSON: Mr. Chairman, referring to the contract under Tab T, Article I, on page 2, outlines the provisions under which the Alberta

Utility Companies can buy annual volumes of base load gas from Alberta and Southern. It points out that the quantities of base load gas delivered under this clause have to be taken at not less than 70 per cent. annual load factor, and that the volumes to be taken in any one year cannot exceed the actual requirements of the domestic, commercial and small industrial customers of the companies, plus the large industrials' requirements up to the limits set out in Schedule A at the back of the contract. The reason for that ceiling is to prevent the companies from buying gas from Alberta and Southern and selling it to some other market other than their own markets.

Clause 2 under this Article I provides for arbitration in case the volumes cannot be agreed on by the parties. Clause 3 provides that the companies shall pay at the weighted average field cost of Alberta and Southern plus the appropriate transmission charge, which would be payable to the Alberta Gas Line Trunk Company for transporting gas from the producing fields to point of take-off from the Trunk Line's system to the company's market.

MR. FRAWLEY: I didn't hear that, Mr. Willson. You were explaining "appropriate transmission charge". Would you say that again?

MR. WILLSON: That assumes that the

agency in the Province carrying gas will be the Alberta Gas Trunk Line, and therefore the transmission charge for the service provided by the transmission company in carrying gas from the producing field to the point adjacent to the company's markets would be payable to the Alberta Gas Trunk Line Company rather than to Alberta and Southern.

I think a commendable feature of these price projects is that the companies pay only the weighted average field cost, and there is no burden of administrative or other costs on Alberta and Southern added to the price payable by the companies.

The second Article covers the sale of gas by Alberta and Southern to the companies for peak load gas. I don't think it is necessary to highlight anything other than the price arrangement which has already been discussed at some length before this Commission, and that is that the price payable is 1.3 times the weighted average field price of Alberta and Southern, or, alternatively, the Alberta companies can return 1.3 cubic feet for every cubic foot delivered. It is the companies' present thinking that the first alternative would be the one followed if deliveries were made under this clause, namely, the price would be paid rather than returning the equivalent volume.

Article III provides for the sale of gas by the Alberta companies to Alberta and Southern

of any volumes it may have that are surplus to its own requirements. It is broken down into two categories: firm gas, which would be supplied on an annual basis, and secondly, summer surplus gas, which would be supplied if Alberta and Southern can take such gas without triggering their take or pay contract provisions, but there is an obligation on Alberta and Southern to take this summer gas if it possibly can. It is not expected at the present time there would be any deliveries to other companies of Alberta and Southern under this clause.

Article IV provides for the reciprocal transmission service between the companies, and it touches on a point that Mr. Pattillo attempted to bring out on Friday, and that is, that if the companies were buying gas at a higher load factor than the companies' market could absorb, and the companies' pipeline facilities may be used to carry this summer surplus gas to the Alberta and Southern system, then the service provided by the company -- the transportation service -- would be paid for by Alberta and Southern at an appropriate tariff, and this revenue would accrue to the benefit of local gas consumers.

Article VI, the term of the contract, provides that the term shall continue for the entire length of the export permit and any extensions thereto.

Article VII is the arbitration clause.

I think those are the principal high-lights of the contract.

THE CHAIRMAN: May I ask you one ques - tion, Mr. Willson: I don't understand fully just where the Alberta Trunk Lines comes into this, on the question Mr. Frawley asked and your reply to it.

MR. WILLSON: The Alberta Gas Trunk Line has been set up by Provincial statute to provide a service to gather gas within the Province for ex-port at local markets, and it is my understanding that the company was set up in order to have a purely Provincial company in that field in order that it would be subject to all Provincial laws and regu-lations. Trans-Canada Pipe Lines have a contract with the Trunk Line Company whereby the Trunk Line is to build facilities to gather gas from all the fields which are under contract to Trans-Canada to transport that gas from the respective fields to a point on the Alberta/Saskatchewan border. It is my understanding that Alberta and Southern have an arrangement with Trunk Line whereby if Alberta and Southern gets the necessary authorization from the Provincial and Federal authorities that the Trunk Line will build the facilities within the Province of Alberta which will transport gas from the various fields to a point on the Alberta/ British Columbia border in the Crow's Nest Pass

area, and for providing that service the Trunk Line Company will be paid an appropriate tariff to cover its expenses, including a return on its investments.

To summarize, it appears that if any further export pipelines are approved from the Province, the pipeline systems in the Province will be built and operated by the Alberta Gas Trunk Line Company.

MR. COMMISSIONER HARDY: How does it come about that the Gas Company proposes to build this line to Pembina themselves?

MR. WILLSON: That is purely a local pipeline which is to serve only local markets, and the company applied to the Minister of Mines and Minerals last Fall for permission to build that particular facility. A public hearing was held in October, and the question of whether or not it was an appropriate time for Trunk Line to build that facility was discussed at some length, and the Provincial authorities decided it was more properly a pipeline to be built and operated by the utility companies rather than the pipeline company.

THE CHAIRMAN: Well, I am not clear on one point: why do we see on all these maps -- and we haven't had the submission from Alberta and Southern yet -- but we have on this map a proposed Alberta and Southern Gas transmission line: why

would that be in existence if all this gas is going to be gathered by the Alberta Trunk Gas line and delivered to Alberta and Southern or its associated and affiliated companies at the border point?

MR. WILLSON: I think, sir, this map is not too well labelled. It would be much better if it were to be labelled, "proposed Alberta Gas Trunk Line pipeline to gather gas for the Alberta and Southern Company", and, similarly, down further where we refer to the proposed Westcoast system; that also, in part at least, would probably be owned and operated by the Trunk Line Company.

THE CHAIRMAN: When you in your agreement propose to buy Alberta and Southern, they haven't got the gas. It is in the transmission lines of the Alberta Trunk Line Company when it is delivered to the utilities, isn't it?

MR. WILLSON: Well, the gas would be owned by Alberta and Southern, and the Alberta Gas Trunk Lines acts just as a common carrier.

THE CHAIRMAN: It would be merely transmitting?

MR. WILLSON: Yes, it is just like a railway transporting goods.

MR. MacKIMMIE: Mr. Chairman, may I on behalf of Alberta and Southern advise the Commission that Alberta and Southern's projects is such

they do not intend to build or operate a new pipeline within the Province. We use the Alberta Trunk Line Company as a transportation facility only.

THE CHAIRMAN: Well, that is what is confusing me, because the maps I have seen have Alberta and Southern Trunk.

MR. MacKIMMIE: I think all it intended to convey was that that was part of the system, but I say that portion of the pipeline would be owned and operated by Alberta Trunk. We would not have any facilities, as such, in the Province.

THE CHAIRMAN: Thank you very much.

MR. FRAWLEY: Mr. Willson, that is why you told me that any transmission charges and arrangements would be between Alberta Trunk and the gas company. As Mr. MacKimmie says, his client is not going to operate any pipe lines. That explains why you tell me that you are going to pay Alberta Trunk the appropriate transmission charge that is mentioned in your contract?

MR. WILLSON: It is rather hypothetical, at the moment, Mr. Frawley, just how it would be handled. It is quite possible that if gas were delivered under this contract, payment would be negotiated between the Alberta gas companies and the trunk line or, alternatively, it seems possible that all trunk line costs would be paid by Alberta and Southern and the appropriate share of the Alberta utility companies could be paid by those companies to Alberta and Southern.

The words "appropriate transmission charge" in the contract of necessity had to be somewhat general, because it is very indefinite at this time just exactly what the arrangements are likely to be a few years down the road and whether or not the Alberta companies will, in fact, buy any gas under this contract.

THE CHAIRMAN: Well, it is merely a matter of mechanics, is it not?

MR. WILLSON: That is all.

MR. COMMISSIONER CUSHING: Mr. Chairman, am I clear, then, that there will be only two companies owning pipe lines in Alberta, and one will be the utility companies and the other will be the Alberta Gas Trunk Line? There are no privately-owned pipe lines other than those two?

MR. WILLSON: There are other utility or gas companies operating in the province. Referring to the map, page 7, under Tab A, the line west, the black dotted line running west from Lake Wabamum to Hinton is owned, of course, by North Canadian Oils Limited and another company that owns and operates gas pipe lines in the province is Mid-western Industrial Gas Company Limited and Ajax Pipe Line Limited.

MR. PATTILLO: And Westcoast Alberta has its system up north, hasn't it?

MR. WILLSON: Yes.

THE CHAIRMAN: Thank you, Mr. Willson.

MR. YORATH: Continuing on, sir, with page 30, the second paragraph: It is expected that the companies will be able to enter into a similar type of contract with Trans-Canada Pipe Lines Limited whereby Alberta requirements would be given priority over those of Trans-Canada's markets with respect to volumes over and above the 4.35 trillion cubic feet which Trans-Canada has already been authorized to take out of Alberta. Discussions for this

purpose have been held with officials of Trans-Canada.

Westcoast Transmission Company Limited have submitted to the Oil and Gas Conservation Board a form of contract under which, according to Westcoast, Alberta consumers would have access to supplies allocated to Westcoast. The companies do not consider that this form of contract affords suitable protection for Alberta consumers and have so stated their position at hearings currently before the Oil and Gas Conservation Board. The companies have stated that if Westcoast is granted a permit to export gas from the southwest corner of the province, then such permission should be contingent on their executing with the two major Alberta utility companies, a contract which is equally as favourable to Alberta consumers as is the contract hereto under Tab T.

Purely for the information of the Commission, sir, we have filed, under Tab U, copies of the last annual reports of our two companies, which do not, I think, require any comment.

Now, coming to Conclusions: The companies' markets for natural gas are expected to triple during the next 30 years.

The annual market requirements 30 years hence are anticipated to be more than 260 billion cubic feet.

Peak demands of 1,650 million cubic feet per day, more than three times Trans-Canada's presently authorized average daily rate of withdrawal from the province must be provided for.

In an area where residents are so dependent upon natural gas for meeting their heating requirements, it is of utmost importance that adequate sources of supply are always available for their use.

The meeting of these annual and peak day requirements demands careful planning and a continuing reassessment of sources of supply and market growth.

The companies realize that decisions must be made today which will have a great impact on the future.

The companies' position at the present time is summarized as follows:

(1) In the interests of the economy and welfare of Alberta and Canada, they consider that it is important to promote and develop the energy resources of the province.

(2) They are not opposed to gas export, providing that local consumers are fully protected.

(3) There must always be in sight a 30-year supply of proven reserves for the residents of the province.

In conclusion, I would like to state that it has been, and will continue to be, the policy of the companies to work with all Government agencies, boards and commissioners, as well as representatives of the markets served and the gas producing industry, with the view to providing natural gas service to the maximum number of residents of the province at the lowest cost consistent with good service.

Respectfully submitted on behalf of our companies, sir.

THE CHAIRMAN: Thank you very much, indeed, Mr. Yorath.

MR. YORATH: Perhaps, sir, it is now convenient to call Mr. Trexel?

THE CHAIRMAN: Yes, sir.

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CARL A. TREXEL, JR., called

BY MR. PATTILLO:

Q. Mr. Trexel, would you please not read the whole of your report. I think that we can take it as read and, if you would confine your reading to the first two sections, that will give us the information as to the nature of your inquiry and then your conclusions that you arrived at.

A. Our report is included in Tab R in the exhibit.

Northwestern Utilities, Limited and Canadian Western Natural Gas Company Limited distribute gas to domestic, commercial, and industrial customers in Edmonton, Calgary, and 68 other communities in central and southern Alberta.

At the present time the greater part of Alberta's energy requirements, exclusive of transportation uses, are supplied by natural gas. In the future, however, alternative energy sources such as coal, heavy fuel oil, and other fuels will play a more important role in supplying energy requirements, particularly to industrial consumers. This may come about because of higher natural gas prices caused by greater competition for gas supplies and the higher cost of additional facilities for producing, gathering, and distributing increased quantities of gas to meet the expected demand.

In June, 1957, Canadian Western and Northwestern Utilities engaged Stanford Research Institute to make an analysis of Alberta's future energy requirements with the following objectives:

1. To determine the future energy requirements, exclusive of transportation uses, of the Province of Alberta and to determine which fuels will probably supply these requirements.
2. To review the effect of low-cost natural

gas on industrial growth in Alberta.

A review and analysis of available statistics on fuel consumption in Alberta was made for the period 1949 to 1956. Based on this analysis, an estimate of the energy consumption in the province by source of energy and by end use -- domestic, commercial, and industrial -- was compiled. Forecasts of the energy requirements of the province by end use were made for 1960, 1965 and 1970. These forecasts were based on projections of per capita energy requirements and a forecast of Alberta's population.

The sources of energy expected to supply the above-mentioned forecast of energy requirements were then estimated, based upon:

1. An analysis and forecast of the availability and prices of coal, fuel oils, and liquefied petroleum gases in Alberta. Information for this analysis was obtained from the railroads and several associations and government agencies, including the Research Council of Alberta, the Coal Operators Association of Western Canada, the Alberta LP Gas Association, and the Alberta Power Commission.

2. A survey of 39 large industrial and commercial fuel consumers in the province

to determine their views toward the use of various fuels.

The assessment of the importance of low-cost natural gas to the industrial growth of the province was based upon the above-mentioned survey of industrial fuel consumers and an analysis of similar studies conducted in the United States.

The general economic framework includes the assumptions that overall economic activity in the province will remain at a high level during the period under consideration and that no major changes in technology will occur to alter present energy consumption patterns.

The study was conducted in the Division of Economics Research of Stanford Research Institute by John W. Gouge and H. Gordon Pearce, assisted by Richard H. Raymond. The project was under the administrative direction of Carl A. Trexel, Jr.

The Institute wishes to express its appreciation for the cooperation and assistance received from the staff of Northwestern Utilities and Canadian Western and from the many other organizations and individuals throughout the province contacted during the course of the study.

Section II, Summary and Conclusions.

1. By 1970, Alberta's total energy requirements, exclusive of transportation uses, will increase to 329 Bcf -- that is billion cubic feet

natural gas equivalent -- an increase of 124 per cent of the 1956 requirements of 147 Bcf. Total consumption of natural gas during this period is expected to increase by 109 per cent, from 106 Bcf in 1956 to 222 Bcf in 1970.

2. Natural gas will probably continue to supply the major part of urban domestic and commercial energy requirements during the forecast period, 1957 to 1970. During this period, however, it is expected that the percentage of total industrial energy requirements provided by natural gas will decrease from 75 per cent in 1956 to 62 per cent in 1970. This reduction is the result of the anticipated loss of certain industrial markets currently served by natural gas.

It is expected that the dieselization program of the railroads will be near completion by 1960. As a result of this program, there will be a potential surplus of about 3,000,000 barrels of heavy fuel oil in Alberta. To aid in disposing of this potential surplus, the oil companies can use the heavy fuel oil in place of natural gas currently used if price of fuel oil reflects its surplus market position. Additional market outlets will be found. The consumption of natural gas by the oil refineries in Alberta is currently about 15 per cent of total industrial natural gas consumption.

At present most of the thermal electric stations in Alberta are gas-fired. The additional thermal electric capacity to be installed prior to 1960 is also expected to be gas-fired. However, after 1960 it is expected that the majority of new thermal electric generating capacity will be coal-fired and that some existing gas-fired stations will convert to coal.

In 1956 about 88 per cent. of the fuel requirements of Alberta thermal electric stations was supplied by natural gas, but by 1970 it is expected that natural gas will provide only about 39 per cent. of the thermal electric stations' requirements. The balance will be supplied largely by coal.

Low-cost natural gas will not be a major factor in the continued industrial growth of Alberta. In July, 1957, a field survey was made, by Stanford Research Institute, of the industrial consumers using 85 per cent. of the total industrial natural gas consumption in Alberta in 1956. This survey showed that none of Alberta's new industries had located in the Province specifically because of the availability of low-cost natural gas as fuel. Two possible exceptions were the ammonia plants and the polyethylene plant which use the natural gas as a raw material. The results of this survey in Alberta are substantiated by other studies conducted

in similar areas which indicate that the most important plant location factors in order of declining importance are markets, labour, raw materials, and transportation.

Future industrial expansion in Alberta will include: (1) expansion of primary industries to utilize raw materials such as crude oil, coal, timber resources, and water; for example, construction of a butadiene plant at Red Deer using butane as a raw material has been announced by the Polymer Corporation; and (2) expansion of secondary industries locating in Alberta because of the growing importance of Prairie markets. Both types of industries will be potential consumers of natural gas for fuel requirements but their decisions to locate in Alberta will not be based primarily on the cost of natural gas as a fuel.

It was suggested that the "Method of Forecasting Energy Requirements" also be read, and it appears under Appendix B. This is just to orient the Chairman and the Commission. It is on page 29 of the report.

THE CHAIRMAN: Yes, would you read that, please?

MR. TREXEL: Method of Forecasting Energy Requirements: 1. Straight-line projections of Alberta per capita energy requirements by end use based on historical data from 1949-1956 were

made to 1960, 1965, and 1970.

2. The per capita energy requirements obtained from the above projections were combined with the British Columbia Research Council population estimates for Alberta -- and the table is on the following page -- to give values of total energy requirements by end use for the years 1960, 1965 and 1970. These values provided an upper limit or what was considered a high forecast of energy requirements.

3. The 1956 per capita energy requirements were combined with the same population forecast as noted above to provide another set of values for energy requirements by end use for the years 1960, 1965, and 1970. This set of values provided a lower limit or what was considered a low forecast.

4. The final forecast was based on the assumption that up to 1960 the actual per capita energy requirements would follow the trend line or the high forecast but that in 1965 and 1970 the increase in per capita energy requirements would be less than those indicated by the trend line. In 1965 and 1970 it was assumed that the energy requirements of the Province would be midway between that indicated by the above-mentioned high and low forecasts. The figures are given in the tabulation below.

I might also mention that we looked at the British Columbia Research Council population estimates, and based on our own work on population growth at the Institute we felt that this was a more realistic population estimate and, therefore, it was used in this study. I mention that because there may be some questions as to why we used this over the one prepared in Alberta.

MR. FRAWLEY: This was a case of British Columbia estimating Alberta's future growth?

MR. TREXEL: That is right, sir, but in similar work we have done in the Institute on population growth in the United States it seemed to give a more realistic picture.

MR. FRAWLEY: In any event, Stanford Research Institute examined it?

MR. TREXEL: That is right.

THE CHAIRMAN: Thank you very much, Mr. Trexel. Will you proceed, Mr. Pattillo?

MR. PATTILLO: Mr. Chairman, I think in the first instance that I will confine my examination to the officers of the company, and then when I have concluded that phase of my examination I will then ask Mr. Trexel a few questions which I would like to address to him.

THE CHAIRMAN: Thank you, Mr. Trexel; that is all for the moment.

MR. D.K. YORATH,
MR. B.F. WILLSON, called

BY MR. PATTILLO:

MR. PATTILLO: We have not very long before the adjournment, but in view of our scheduling I will take, I think, these few minutes, if I may, Mr. Chairman.

A. Would you please look at Tab P, page 1? Am I correct in thinking that of the reserves as of now, according to your calculation, of 17 trillion cubic feet, of the dry sweet gas, amounting to 7 trillion cubic feet, your companies have under their control approximately 11 per cent.?

MR. WILLSON: Yes, sir. I would make it, without the Carbon field, about 10 per cent., and with the Carbon field about 12 1/5 per cent.

Q. And of the sour and condensate field gas you have approximately 10 per cent. under your companies' control?

MR. WILLSON: Yes; with the Okotoks field added in it is about 10 per cent.

Q. Now, do you agree with me that as far as the gas cap gas being taken into a consideration of reserves available is concerned, those reserves will not be available until such time as the oil which they facilitate the removal of has been removed?

MR. WILLSON: Yes, sir, that is correct.

Q. And that if one is looking at present reserves it is not very realistic to include gas cap gas?

MR. WILLSON: I think it is in the long-term view of the situation, Mr. Pattillo.

Q. Well, to look at that as a part of your reserves that are available, does not a great deal depend upon the rate at which the oil is being produced?

MR. WILLSON: Yes, that is correct.

Q. And if the market conditions for oil as they now exist in the Province of Alberta do not improve the period of time in which that gas becomes available is pushed further and further forward into the future?

MR. WILLSON: That is correct.

Q. And when one is looking at solution gas there the rate of production of the oil is important, and also the cost of the development of the by-products and the market for them must be taken into consideration?

MR. WILLSON: That is correct.

Q. Now, of these 17 trillion cubic feet you people presently have altogether about 3 trillion cubic feet under your control; is that correct?

MR. WILLSON: Yes, sir, it is in that order.

Q. But to meet the anticipated requirements for the next 30 years you have to have under your control in addition another 4 trillions?

MR. WILLSON: Yes, sir.

Q. So that when we are talking about reserves available, assuming there are 17 trillions that are available, 7 trillions of that would have to be taken off for your companies' looking ahead for 30 years?

MR. WILLSON: Yes, if it is assumed that the requirements for deliverability in the thirtieth year should be provided for at this particular time.

Q. Yes. Well, when you are talking about the rolling 30 years you must say that, must you not?

MR. WILLSON: Well, we have assumed, and I believe the Conservation Board has also, that the reserves necessary to provide deliverability in the thirtieth year can properly come out of the trend situation, especially as a result of the growth of Alberta's reserves, and it is unduly conservative to provide for the requirements in the thirtieth year out of present improving reserves.

Q. Is not that entirely different from what Mr. Yorath in the brief at page ---

MR. YORATH: It is page 28.

MR. PATTILLO: Q. Yes. "... on every occasion when an export permit is being considered.."

-- let us assume we are considering one right this very minute -- "...the proposed exporter shall establish that in addition to any quantities the export of which is requested there is sufficient supply to meet the requirements of the distributors for a rolling period of not less than 30 years."

Now, as I understood Mr. Yorath, that meant that at the very moment of the consideration you had to be certain there were adequate supplies for the next 30 years for the consumers in Alberta?

MR. WILLSON: Yes, sir.

Q. Now, I just want to get back here again. Say that out of these 17 trillions your requirements are 7 trillions, looking ahead for the next 30 years; I would like you to tell me if you have given any consideration to what percentage of those 7 trillions would have to be dry, sweet gas or sour and condensate field gas rather than associated gas?

MR. WILLSON: No, we have not analyzed the situation in that manner, Mr. Pattillo.

Q. Do you not consider that it is important in determining whether the requirements of the Province can be met out of present reserves for the next 30 years to break down what percentage would have to be set aside of the two categories of gas that I have mentioned?

MR. WILLSON: Well, it is not our contention that specific reserves should be set aside, as such, for local use. I do not think that is a realistic thing to do. Our thinking is based on meeting developments as they occur and as the company is able to, or can afford to, add to its dry gas reserves it certainly will do so. We have never considered it a practical approach to break down the total 30-year requirements into various categories and then go out and try to acquire the reserves in that pattern.

Q. Well, just going to that, I want to be sure I clearly understand what has been the practice in the Province. At the time that Trans-Canada made its application for an export permit, am I correct in thinking they had to present to the Board evidence that they had contracted with producers within the Province for the supplies which they sought to export?

MR. WILLSON: I was not present at the Trans-Canada hearings and I am really not qualified to answer your question.

Q. You do not know anything about the practice that is followed?

MR. WILLSON: I believe, at that time, it was not as necessary to file actual contracts for supplies to the same extent as it is today and, I believe, in the Trans-Canada case that contracts with producers ---

Q. Perhaps I can get at what I am seeking to achieve by talking about what is the present practice: As I understand it, at the present time, if a company was seeking the right to export gas from the Province they would be required to show that they had entered into contracts with producers within the Province for the supplies which they sought to export. That would be one thing.

MR. WILLSON: Yes, I believe the requirement is for 80 per cent.

Q. 80 percent; then they are also required to show that after their requirements have been taken care of and the requirements of gas previously permitted to be exported have been deducted, there will still be sufficient in the reserves to meet the 30-year requirements of the consumers in Alberta. Is that correct?

MR. WILLSON: That is my understanding.

Q. Now, Mr. Willson, let us take the situation of the three companies; Trans-Canada enters into contracts with certain producers, Westcoast enters

into contracts with certain producers, and Alberta and Southern enters into contracts with certain producers, and your companies have certain fields that they own. Is not the result of that simply this: that the producer in Alberta who does not get a contract with one of the four of you is having his field allocated for the future supply of the Province?

MR. WILLSON: That could result from that approach to the problem; that is correct.

Q. There is no other result, is there? There is the allocation you people say you are opposed to.

MR. WILLSON: It is not so much an allocation, as I understand it, but just a difference; that there is sufficient gas to look after the 30-year requirements of the Province, and there is no suggestion that any particular field must be allocated to that use.

Q. No, but is not the result of it this: if I am a producer in this Province and I have not been able to get a contract with one of the companies, then the situation is that my reserves which have been taken into the sum calculation have been automatically set aside as available only for domestic consumption?

MR. WILLSON: Not in perpetuity.

Q. Until such time as some other export

permit seeker comes in and has entered into a contract with me and can establish the facts that we have just stated?

MR. WILLSON: Yes, or extensions of existing permits.

Q. So that my position is, if I am a producer, unless somebody comes along in the future and can establish additional reserves proved up so he can get an export permit, I have to sit and wait until such time as your companies are prepared to enter into a contract with me to take my gas; is that correct?

MR. WILLSON: That is not our companies' policy to arrange that situation. Essentially ---

Q. Is it the fact?

MR. WILLSON: To my knowledge, while it may be a fact it is not a problem.

Q. Some of the producers who have been fortunate enough to be in the area where Alberta and Southern seek to get export gas are certainly getting higher offers of prices than the people who are not in this area. Is that not so?

MR. WILLSON: Well, the offers of Alberta and Southern and Westcoast have, of necessity, been confined to areas within economic distance of the facilities they are proposing, and to that extent you are certainly correct.

Q. If you are correct about that, then

are you not allocating the uneconomic areas, as far as transmission distances are concerned, to the Province for the future?

MR. WILLSON: We are not doing that, Mr. Pattillo.

Q. Is that not what the result of the present policy does?

MR. WILLSON: It could have that effect, and we object to it if it does have that effect.

---Whereupon the hearing adjourned at 12.20 P.M. until 2.05 P.M.

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---Upon resuming at 2.05 P.M.

THE CHAIRMAN: Gentlemen, we will now resume the hearing.

BY MR. PATTILLO:

Q. Before lunch we were dealing with what the factual situation was as the result, not of policy, I do not want it to be understood that I am suggesting policy, but practice -- your companies consider that it would be a very poor move, particularly to the consumers, if you went out today and bought your future requirements for the next 30 years and that it would cost you in the vicinity of $100 million, which would have to be added to the rate base. Now, is this fair: if your companies do not go out and do that, then must it not follow that in the future you will have to buy gas to supply your consumers at the then competitive rates, or you will have to rely on the Province or, at least, Provincial authorities allocating fields for your purpose?

MR. WILLSON: That is correct.

Q. Have you made a study, having regard to the increases in prices, for gas that occurred in the Province of Alberta in the last few years being paid by "X" companies desirous of exporting and projecting into the future. Have you made a study to determine, as well as it is possible to do,

which would be the cheaper thing to do for the consumer: going to the market now and buying the requirements you are going to need, or buying at competitive prices as they may occur in the future?

MR. WILLSON: Yes, we have made such a study.

Q. As a result of that study, I am discounting from that study that there is any allocation to you that you must buy in the competitive market; now, as a result of that study which have you found to be, in your judgment, the cheaper?

MR. WILLSON: We feel it is more economic to be prepared to pay the going price in the future, rather than going out and buying sufficient gas now for a 30-year period.

Q. In making that study have you given any consideration to approaching the producers now and assuring supply for the future with an escalation clause in the contracts whereby when they send out gas to you the prices would be determined from the then prevailing average prices, or anything like that?

MR. WILLSON: We have stated, as a matter of policy, to producers that we are prepared to pay the going price in future years, but in talking to any producers or group of producers with respect to a specific field, they not only want to know the

unit price, but they also want to know the annual volumes the companies will be able to buy.

Q. They do not want to be put in a position where their pay-out is much longer in terms than the producers who are selling to the export companies?

MR. WILLSON: That is right.

Q. Have you given any consideration to a scheme such as this, Mr. Willson: if you had a grid system which operated throughout the length and breadth of the Province, and acted as a transmission line for any producer to which you chose to hook up or which chose to hook up with it, that then the future requirements of the people of Alberta, the people in the rest of Canada, and the people in the United States might be resolved by your companies first, allocating to the Provincial requirements your present reserve, and then, having an agreement whereby the percentages that you needed at all times to make your supplies available to the consuming public, and the percentages that might be needed to supplement the reserves, for instance, that Trans-Canada has for the rest of Canada in the East, would be determined by, first, ascertaining how much it had contracted for and how much more it would need, percentage-wise, and the same procedure should be followed, for example, with Alberta Southern and Westcoast or any other

exporter that might come into the market later so that the supplies collected from all the producers would be sorted out in percentages? Have you ever given any thought to such a scheme as that?

MR. WILLSON: Only very generally. The cost of gas transmission lines is such that in our view such a scheme would not be practicable. In other words, there are in the Province a number of reserves which, by themselves, are not within economic reach of major pipelines or Provincial markets.

Q. Just stopping there: have they been taken into consideration in giving these reserve figures?

MR. WILLSON: I believe they are all included in the Conservation Board's report of the Provincial reserves of the Province, but, as a result of the present degree of development, they are not of sufficient size to justify pipelines going into the area in which they exist and, as a result, they are somewhat immobilized until either the reserve increases, due to further drilling, or the price goes up and it becomes economic to pick them up.

Q. Looking at the map for a moment, what you are saying now is that Alberta and Southern come up this way, as I understand they propose to

do for export, and Westcoast comes in around the vicinity of Calgary South and Trans-Canada is collecting from this area (indicating on map), and you people are collecting from here (indicating on map). Is not all the rest which you say is available for Provincial consumption and to supply the extra 4 trillion you need in what is now an uneconomic area?

MR. WILLSON: We have not made an analysis as to what is within economic reach of pipelines and markets, and what is not within economic reach. I think the Conservation Board in its analysis of the situation must include quite a bit of gas that is in that category that you mention.

Q. Well, Mr. Willson, as a person who says, in this brief, they are vitally concerned about the local consumers, is it not essential that you ascertain whether the quantities of gas that are taken into consideration for local consumption are or are not within the economic areas?

MR. WILLSON: We have never, as a matter of policy, gone out to line up a 30-year supply because of the terrific costs involved in doing so. As an alternative, we have entered into this contract with Alberta Southern which guarantees us a 30-year supply out of the supplies they propose to contract for, and we think that is a much more economic approach to the problem rather than going into

all these remote fields with these high transmission costs and having the local consumer pay those costs.

Q. I intend to go into Alberta and Southern presently. The answer is, you really have not given this study?

MR. WILLSON: We have made no study of building pipelines all over the Province to pick up those small fields.

Q. N w, let us just look for a moment at this Alberta and Southern contract. As I understand it, the utility companies have a financial interest in this company; is that correct?

MR. YORATH: Not in Alberta and Southern; we have a financial interest in Pacific Coast Transmission Company.

Q. That would be the company that runs from the American border?

MR. YORATH: To the California border.

Q. To the California border.

MR. YORATH: I can give you that, if you like, Mr. Pattillo.

Q. Yes, all right.

MR.YORATH: The Pacific Gas Transmission Company -- at the present time the equity stock ownership is Pacific Gas and Electric own 50 per cent -- or will; Bechtel Corporation, 9 per cent; Blyth & Company, 7 per cent; our two utilities companies, 7 per cent.

MR. HELMAN: Is that 7 per cent each, or together?

MR. YORATH: Together. Manitoba Power, 2 per cent, making a total of 25 per cent -- that is, exclusive of Pacific Gas and Electric's 50 per cent. The remaining 25 per cent will be offered to the public.

MR. PATTILLO: Q. And your percentages are on the basis of authorized stock and not issued stock?

MR. YORATH: That is correct.

Q. So that when all the stock authorized is issued, you will still have the 7 per cent?

MR. YORATH: That is right -- if we elect to buy.

Q. You merely have an option, is that it?

MR. YORATH: That is what it amounts to, yes.

MR. HELMAN: Mr. Chairman, could I have that document filed? I would like to look at it.

MR. YORATH: I am just reading from a rough memorandum, Mr. Helman.

THE CHAIRMAN: Would you provide Mr. Helman with it? I think what you have put on the record is sufficient for the Commission's purposes, and if Mr. Helman wants to look at it, you could show it to him, perhaps.

MR. PATTILLO: Q. I want to be sure I clearly understand this Alberta and Southern agreement between the utilities and it: if Alberta and Southern are called upon to supply gas to your utilities, your company has the election to pay for that in money or to use your own reserves to replace the gas you have taken down; is that correct?

MR. WILLSON: That is correct with respect to peak gas supplies.

Q. Right.

MR. WILLSON: With respect to annual base load volumes, the provision is that we just pay their weighted average field price.

Q. You pay for that. You have no right to replace?

MR. WILLSON: No, except to the extent we might sell them gas from fields of our own and replace it in that way.

Q. Well, have you the right under this contract to sell your gas to them if you elect to do so?

MR. WILLSON: Yes, we have.

Q. And the result would be that if you did make that election you would be selling what, in relation to the price they are going to have to pay for their gas, is much cheaper gas?

MR. WILLSON: At the moment that price is somewhat less than they are offering.

Q. Yes, and if you sold your gas to them at the prices which they are offering to others, the result would be that your utilities would make a very handsome profit on that transaction?

MR. WILLSON: Our consumers would. The whole benefit would accrue to the consumers.

Q. But first the utilities would make that, and that benefit would go over to the consumer?

MR. WILLSON: That is correct.

Q. Is that contemplated as a probable thing that may happen, Mr. Willson?

MR. WILLSON: No, we don't expect that will happen.

Q. As to this 1.3: in arriving at the agreement to pay that for peak gas, did you make any studies as to how that would work out costwise as opposed to using propane to cut down peak load requirements?

MR. WILLSON: We didn't make any specific studies; we just know it would be much less than using propane.

Q. There are substantial quantities of propane available in this province that could be used to cut down peak load requirements?

MR. WILLSON: Not at the moment. There is a shortage of propane this winter, but I think in the long term there will be substantial volume.

Q. Let us put it the same way as the gas: there are a lot of potential reserves?

MR. WILLSON: Yes.

Q. You say the use of propane to cut down peak requirements would be more expensive, in your opinion?

MR. WILLSON: Much more expensive.

Q. How was this 1.3 arrived at? Would you explain that?

MR. WILLSON: Well, it was basically an arm's length bargain.

Q. Did you people have your 7 per cent interest at the time the contract was made?

MR. YORATH: No, at that time the actual extent of our participation had not been determined.

Q. Had there been any agreement to take a participation, the extent of which had not been determined?

MR. YORATH: It was understood at that time we would participate.

Q. Would you continue telling us about this arm's length deal, Mr. Willson?

MR. WILLSON: In negotiating the contract it was recognized that the most practical arrangement for breaking the companies' requirements down into two parts lay in assuming certain volumes as base load gas and other volumes as the peak load gas, and once that decision was made, that volumes would be handled on one basis or other, it was then necessary to negotiate the terms and conditions for each particular type of gas, and agreement was reached that base load gas would be at the Alberta and Southern weighted average field price, and it was recognized that some premium was appropriate for peak load gas, and 1.3 was agreed upon by the parties as being appropriate.

Q. Just a matter of agreement? There is no other base you can give us for this 1.3 as opposed to the same calculation for the base load gas?

MR. WILLSON: No, the 1.3 is not a mathematically derived figure.

Q. Right. Now, as I understand it, Westcoast offered your utility companies a proposal whereby they would supply your gas requirements under certain terms and conditions?

MR. WILLSON: Westcoast suggested the contract which, according to their representations, would be the arrangement whereby they would deliver gas to our companies for use within the province. We felt it was not an adequate document covering the

very complex matter of the supply of gas.

Q. I was just going to ask you what your real criticism in principle was to that contract which, as I understand it, calls for you paying cost to them of the gas?

MR. WILLSON: There are a number of things which we feel are inadequate: first of all, the volume of gas to be delivered is not clearly set forth, as in the Alberta and Southern agreement. Under the Alberta and Southern agreement we have the right to buy our entire requirements from Alberta and Southern, whereas under the Westcoast proposal it was suggested we could only call on them for gas . . .

Q. Surplus?

MR. WILLSON: . . . that they could reasonably supply and gas which we could not reasonably supply. We felt that could be construed that we had to deplete all our present fields before we could call on them for everything. With respect to the matter of price ---

Q. Surely, you would not call on Alberta and Southern for all your supplies as long as you had your own fields of much cheaper gas, would you? In other words, from the practical point of view is there any difference between those two?

MR. WILLSON: Very much so. Under our

arrangement with Alberta and Southern we can retain our dry gas fields for peaking purposes indefinitely.

Q. Yes?

MR. WILLSON: Whereas it is certainly not clear under the Westcoast agreement whether that would be possible.

Q. Right.

MR. WILLSON: On the matter of price, Westcoast suggested we would pay their cost plus a number of other costs including administration and overhead expense, which is not the case with the Alberta and Southern gas. So, it seemed to us, price-wise, it was not nearly as favourable for our consumers as the Alberta and Southern contract. I think one of the basic problems was Westcoast just didn't have the gas under the contract with which to perform under the contract.

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Q. Would you please look at this contract with Alberta and Southern and, particularly, Article III, page 6. That is found in Appendix T.

Now, am I correct in thinking that the effect of Clauses 1 and 2 of Article III is that you have got one shot only to determine the quantity of firm gas that you want to take and that that must be exercised prior to the hearing before the Oil and Gas Conservation Board for the permit to export gas and that, following that, if you give three years' written notice, you have a right to reduce that quantity?

MR. WILLSON: There is probably a little confusion here, Mr. Pattillo, with respect to the words "gas company". That applies to Alberta and Southern.

Q. Yes.

MR. WILLSON: Article III covers any gas that we might have to sell to Alberta and Southern, the sales of gas by Alberta Utilities to the Gas Company.

Q. You have to say how much you are prepared to sell?

MR. WILLSON: Yes.

Q. And that becomes a firm contract to purchase, by them?

MR. WILLSON: That is correct.

Q. Under that, have you made such an

election, as yet?

MR. WILLSON: We have told them we have no firm gas to sell them.

Q Right.

MR. WILLSON: This provision was, largely, to cover the situation that, if a lot of additional reserves were found close to our pipeline that were obviously surplus to local markets, they could be delivered to the Alberta and Southern project through our pipelines.

MR. PATTILLO: Those are the only questions I wish to address to these gentlemen. I have a couple of questions I would like to ask Mr. Trexel.

Q. Mr. Trexel, on page 22 of the companies' submission, read by Mr. Yorath, at the very bottom of the page, the statement is made, "In order to attract industry to Alberta it is necessary to keep industrial gas rates as low as possible."

From the investigation that your Institute made, would you agree with that statement?

MR. TREXEL: I do not feel that I am qualified to answer that particular question. We did look at low-cost natural gas as a factor in the industrial growth of Alberta, and that is included in Section 5 of the report.

As I mentioned, in the summary of the report, it is quite far down on the list of the

factors that are considered by companies in locating in a particular area; in fact, it is about ninth on the list, as I recall.

Q. As I understand it, from your investigation you came to the conclusion that, in the not-too-remote future, the price of natural gas was going to increase to the point where coal would be a cheaper source of energy, in some places in the Province, for industrial use?

MR. TREXEL: That is correct.

Q. Would the result of that, in your opinion, release more natural gas produced in the Province for export?

MR. TREXEL: If our analysis is correct -- and we are looking this far into the future -- I would say yes, that it would release some additional gas for export. At least, it would release it for use; not necessarily export, but, also, it could be used in the Province.

MR. PATTILLO: Thank you. Mr. Frawley, I think you should go first.

BY MR. FRAWLEY:

Q. Mr. Yorath, you say, at the bottom of page 1 of your conclusions, that your companies are not opposed to gas export, providing that local consumers are fully protected?

MR. YORATH: Yes, sir.

Q. And you say, at the bottom of page 26, "It seems inevitable that if we wish to have our gas resources developed we must also have export of gas in sizeable volume."

MR. YORATH: Yes, sir.

Q. So it would not be unfair to just re-arrange what you said at the bottom of page 1 of your conclusions to say that you are in favour of gas export and you feel that the Alberta Southern project is a good way in which to have gas export?

MR. YORATH: You can certainly re-arrange that that way, Mr. Frawley, most emphatically.

Q. You are not opposed to the export that is already underway, eastbound, by Trans-Canada?

MR. YORATH: No, sir.

Q. So it is fair to say that your companies, the gas utilities of Alberta, feel that gas export is a necessary thing for the proper development of our natural resources?

MR. YORATH: Unquestionably so, sir, if we have 30 years rolling.

Q. By the way, you were asked what you meant by "rolling" and, looking at what you say at the top of page 2 of your conclusions, "There must always be in sight a 30-year supply of proven reserves ...."

That is what you meant by "rolling", that at any given time you must see 30 years?

MR. YORATH: Correct.

Q. I was quite struck by Mr. Pattillo's questioning of you this morning about these fields that would be left, like orphans, as it were, not tied up to any one of the known exporters or would-be exporters and not having been purchased by your companies. Are there such fields and where are they and what are their names? There may be, but I would like to know something more of them.

MR. YORATH: I think I will have to bow to Mr. Willson, on that one. He has a greater knowledge of the location of the fields than I have.

MR. WILLSON: I don't know what fields Mr. Pattillo had in mind when he was talking about that situation, Mr. Frawley. There are some that possibly he might have had in mind.

For example, there is the Bells Hill Lake field, which is in this area here (indicating on large map), just about 30 or 40 miles south of our pipeline and it is probably 50 miles or more from this proposed trunk line, and this is a reserve of the order of 50 billion cubic feet. At the present time our companies are studying it as a source of supply for the communities of Hardisty, Killam and Sedgwick; but those communities will not be a large market outlet for that field, and, because of the

geographical location of it, the owners of gas in that field are not going to get as rapid a market outlet as if their field were located, say, 5 or 10 miles from this particular pipeline.

Q. Does what you are saying amount to this, that you will study those fields and it is more than likely that you will join them up as part of your own reserves?

MR. WILLSON: We are studying this particular field now. Undoubtedly there must be many others that fall in between these pipe lines, and are not sufficient to warrant an extension. In other words, the cost of transporting it to an existing or proposed pipe line is just too great to justify it for the relatively small amount of gas involved.

Q. What is the ultimate future for fields of that kind?

MR. WILLSON: I think two things will happen. Undoubtedly, additional gas will be found in this area of Bellshill Lake, and other fields will be large enough to warrant a line going into them, or, secondly, the value of the gas will go up to the point where the previously uneconomic situation will be gone because the value of the product is higher.

Q. I was only concerned with what Mr.Pattillo was putting to you. You would not think that that field would fall into the category where you have a field for thirty years before you can possibly effect a sale of the gas?

MR. WILLSON: In some cases it could be

30 years, and in some cases much less than that.

Q. Let us look at this Alberta and Southern project. That is quite a project, is it not?

MR. WILLSON: Yes, sir.

Q. And it is a project that contemplates taking 400 million cubic feet of gas a day when it gets going?

MR. WILLSON: That is correct.

Q. They have not only -- I have looked quickly at their submission -- they have not only contracted with certain fields on what you might call a future basis but they have also put under option vast areas which are only reserves at the moment. That is true, is it not?

MR. WILLSON: That is my understanding of the situation.

Q. For that reason I find it a little difficult to understand why they would leave out fields unless they were completely uneconomical.

MR. WILLSON: They can answer this question much better than I can, but I would assume that they have made approaches to producers in every field within economic distance of their proposed project.

Q. I assume it is fair to say also this, that that scheme has not even been considered by the Conservation Board?

MR. WILLSON: That is right.

Q. And many, many possibilities exist throughout the course of that inquiry?

MR. WILLSON: That is very true.

Q. And conditions might be imposed upon the would-be exporter by the Conservation Board that could conceivably clear up the point that Mr. Pattillo was developing this morning? Do you not think so?

MR. WILLSON: Well, I was not just quite sure of the point Mr. Pattillo was making this morning.

Q. Mr. Pattillo has given me a list of some fields, and I want to deal with each of them specifically. The Irma section of the Viking-Kinsella field is what I would call an "orphan", in a very inexpert way. What would you say about that?

MR. WILLSON: Well, in our view, and in the view of our consulting geologists, the section referred to, the Irma section of the Viking-Kinsella field, is not economical to develop. The sand is from two to three feet in thickness, and while there are undoubtedly gas reserves there the cost of producing and gathering that gas is such that it is much more costly than would be justified at the present time.

Q. It is not very far away mileage-wise

from your Viking-Kinsella line?

MR. WILLSON: No, it is probably within eight or ten miles of our gathering system.

Q. And neither Alberta and Southern nor Westcoast want it either?

MR. WILLSON: It is a very small reserve, Mr. Frawley, and is many, many miles from their facilities.

Q. How about the basal qualities of the D-3 section of the Acheson field?

MR. WILLSON: We have offered to buy gas from those horizons. As a matter of fact, we are buying D-3 gas from Acheson right now.

Q. Well, you do not think those two fields would be a problem?

MR. WILLSON: No.

Q. How about the Turin field?

MR. WILLSON: Well, that is a matter of opinion as to whether it is an economic proposition. It is located in this general area here north of our 16-inch line from Bow Island to Calgary. The situation at the moment is this, that we have 55 million cubic feet a day deliverability from Bow Island and from Foremost by a line which is not shown on this map, and that exactly matches the capacity of this pipe line to deliver gas ---

Q. Which pipe line?

MR. WILLSON: Canadian Western's 16-inch

line from Bow Island up to Calgary, which is purely a peak load supply of gas, and even if the Turin field were connected it would not provide a further increase in our system's capacity because of the fact that this pipe line itself will not carry any more gas than is presently carried.

Now, as a reserve for the entire system the company, under its present contract at Jumping Pound, is required to give priority in its market growth to the Jumping Pound and Okotoks fields until such time as the capacity of these areas has been reached, and at that time the company will be in a position, assuming its market continues to grow, to offer markets to additional fields, but we feel that is probably six or seven years in the future, and we have no market to offer to this Turin field at the present moment. It is just a position that the companies' sources of supply at the present and for the next few years to come on an annual basis are quite capable of meeting the companies' markets. It is the peak winter gas which is the problem in the companies' western system, and it is proposed that the Carbon field be connected to supply peak gas which will be wholly deliverable to the companies' market in the Calgary area.

Q. Now, Mr. Willson, just speaking of peak gas, you are agreeing to pay Alberta and

Southern a premium for peaking of gas?

MR. WILLSON: That is correct.

Q. But at another point in your evidence, when you were describing the virtues of the Alberta and Southern agreement as against the Westcoast agreement, or the Westcoast negotiations that you have had, you said you could retain under the Alberta and Southern arrangement your dry gas fields for peaking. Why must you pay Alberta and Southern a premium of 1.3 if you are going to have dry gas fields by acquiring the new one just now at Carbon? Is that not going to look after your peaking requirements?

MR. WILLSON: We expect it will, and based on our studies of the next 15 or 20 years we do not see any requirement to buy gas under that 1.3 provision.

Q. That is very interesting. It is just a matter of insurance, then? You do not contemplate paying Mr. MacKimmie's clients the 1.3, really?

MR. WILLSON: No, sir.

MR. YORATH: I do not think Mr. MacKimmie contemplates collecting.

MR. FRAWLEY: Q. Because, you see, you are not paying Mr. MacKimmie's clients anything for what you might call your base load because he is just turning it over to you for what he pays for it?

MR. WILLSON: That is right.

Q. But you are giving him something for any peaking gas you buy from him?

MR. WILLSON: That is right.

Q. But you do not expect to buy any?

MR. WILLSON: No.

Q. Now, you had some negotiations with Westcoast about supplying you with your gas requirements in whole or in part?

MR. WILLSON: Well, they submitted a draft contract to us. It was part of their submission, actually, to the Oil and Gas Conservation Board in connection with their application that is currently before the Board.

Q. Well, did you not sit around a table and have a discussion with Westcoast like you had with Alberta and Southern?

MR. WILLSON: No, sir.

Q. Well, why not?

MR. WILLSON: Well, we commented on the contract before the Board and made our views quite clear on it. I think they omitted ---

Q. Yes, it could be that you made your views clear because in your statement, some place, you say you regarded the Westcoast proposals in looking for a Calgary supply or an Alberta supply as not affording suitable protection for Alberta consumers, and that you had made your views known to the Oil and Gas Conservation Board, but I am

anxious to have you tell me why you did not actually negotiate with those people like you did with Alberta and Southern. I am wondering why you did not.

MR. WILLSON: Well, they never invited us to.

Q. Yes, but you are the people who are responsible for the gas supplies of the Province of Alberta, and have been for many years and I hope will go on being so for a good many years in the future, and you must be prepared to negotiate with Westcoast on a businesslike basis in just the same way as you did with Alberta and Southern?

MR. WILLSON: We would be very glad to negotiate with them, but we did not think it was our job to initiate the negotiations.

Q. Who initiated the negotiations that culminated in the agreement between you and Alberta and Southern?

MR. WILLSON: Alberta and Southern.

MR. YORATH: Or Pacific Gas Transmission.

MR. FRAWLEY: Q. Just apropos what Mr. Pattillo said to you a moment ago, and the fact that your two companies have a 7 per cent interest in Pacific Gas Transmission, it is not because you have a financial interest in that Alberta and Southern project that you are negotiating with them rather than with Westcoast, is it?

MR. YORATH: That is a correct statement.

Q. The way I have put it -- that is not the reason?

MR. YORATH: That is not the reason. They approached us, and we recognized that they had a project or a proposal which was in our interest, and which was the best arrangement we could make for the protection of the Alberta consumers. We entered into that deal at that time, and our participation was discussed.

Q. The only reason I am following it up is this, that they both propose export.

MR. YORATH: That is correct.

Q. And export, you say, is the best way to develop our gas resources to provide the incentive for putting the holes down that are not down yet but which have got to go down to develop the gas resources that are there, and because they are both proposed potential exporters it just struck me that you should have negotiated as seriously with the one as with the other. Now, there may be a ready answer to that suggestion.

MR. YORATH: Shall I put it this way, Mr. Frawley, that when we first entered into our negotiations with Pacific Gas and Electric, when they approached us, we made an arrangement with them that if they were successful in getting a permit we were satisfied to look after our interests. Westcoast proceeded with their application. There was

no contact made by them with us, and it was not until a few days before the date of the hearing was set that I heard they were endeavouring to file an agreement such as has been outlined today between Westcoast Gas Transmission and Alberta and Southern, and they were good enough to give us copies of that agreement a few days before the hearing. We looked it over, and at the hearing we pointed out to the Conservation Board that in our opinion it did not meet our requirements in protecting the Alberta consumers, and one of the basic reasons was, as Mr. Willson pointed out a little earlier, that the amount of gas they were applying to export consumed or took up all of the gas that they had under contract. They were suggesting there were certain other fields adjacent to their system that would be available to us. What those were, and what the availability of them was, I do not know, but it was considered that we would have to connect those fields ourselves, and I would say it would be much more costly to the Alberta consumer to do so than under our arrangement with Alberta and Southern.

Q. You say, quite frankly, that what Westcoast offered was not adequate for you -- it did not provide for this and it did not provide for that -- but it strikes me that you might have said to them: "If you will provide for this and for that,

and if you will insert such a term and such a term, we would like to discuss it with you further."
Did you do anything like that?

MR. YORATH: No, I cannot recollect making any definite approach to them along those lines. Can you, Mr. Willson? May I consult with Mr. Willson on that?

Q. Yes.

MR. YORATH: We did make it clear at the hearing, yes.

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Q. You see, you leave it this way: at the bottom of page 30, you think Westcoast must be prepared, if they are granted a permit, to execute a contract which is equally as favourable to Alberta consumers as the contract you now have with Alberta and Southern.

MR. YORATH: That is right.

Q. And are you saying it must be as equally favourable a contract or not?

MR. YORATH: They are fully aware of the Alberta Southern contract and the first contract they presented at the first portion of the Westcoast hearing when they re-convened, I think, January 28th was amended by another contract which was more favourable to us and which we still considered not to be satisfactory.

Q. Is it not a fact, Mr. Yorath, that the Alberta Southern contract envisaged much more gas than the Westcoast?

MR. YORATH: That is right.

Q. And perhaps it is fair to say that was the major consideration in your mind in not following the matter up with Westcoast like you did with Southern Alberta?

MR. YORATH: And because of the gas we understand they have under contract or under option.

Q. Can you tell me, looking at your contract with Alberta Southern, Article I, which deals

with purchases by you from Alberta Southern of base gas, would that be a fair way to describe it, base gas?

MR. YORATH: Yes.

Q Can you tell me what percentage of your total requirements do you expect to be supplied by Alberta and Southern, vis-a-vis your own existing contract or your own owned supply?

MR. YORATH: We are now in Mr. Willson's territory and I will let him answer.

MR. WILLSON: We have made certain projections of methods in which the companies' markets might be supplied and the percentage varies in various areas. As I recall, any gas for Canadian Western Company, assuming that no additional fields are discovered, the most economical source of gas for Calgary would be found in the Alberta and Southern facilities. As I recall, the first year of any deliveries would be around 1954, and it was a very small percentage of the total, and that year we bought from Alberta and Southern, but the percentage supplied by Alberta and Southern increased as the companies' own supplies remained steady or maybe even dropped, and the companies' markets continued to grow. The quantities from Alberta and Southern would grow annually and the percentage of the total market would grow. This was on the assumption that no additional discoveries were made

adjacent to the companies' system which, I do not think, is a very realistic assumption. I think it is more proper to assume that additional discoveries will be made and will be supplying the companies' system 15 or 20 years from now; discoveries we know nothing about today.

Q. You intend, I take it, to pursue the same aggressive geological development in the future as you have during the past years? Is that so, or are you going to slow up now that you have tied in with Alberta and Southern?

MR. WILLSON: No, we do not carry on exploration work as such. In the Edmonton area where drilling is less costly, we do follow up on discoveries of others wherever we can negotiate leases in large enough blocks to make development of the company economically sound, and we propose to continue to do that; but in the Calgary area, where drilling costs are much higher, we think it would be a mistake to compete with the oil companies in the exploration business and we think it is a much better arrangement for our consumers to allow the oil companies to discover major gas reserves and develop them, and we would buy the gas as developed and purchase from such companies. The companies, as a matter of policy and as a matter of expediency, had to develop their dry gas peaking facilities because we could not interest

any producers in developing gas where a very low load factor exists for peaking supplies. We intend to follow the same policy in future years as we have in the past years.

Q. Going back again to the 1.3 which, of course, does not strike me as being very important in the light of what you said a few minutes ago, is it true that Alberta and Southern did agree to give you your base load gas just at what it cost them?

MR. WILLSON: Right.

Q Do you not think it would still be possible to drive a bargain with them to let you have your peaking gas on the same basis?

MR. MacKIMMIE: I guess I can leave now.

MR. WILLSON: As a practical matter, we signed the contract on the basis of the present provisions which we thought were favourable and it would not be fair to welch on that contract.

Q. I am not one to tear up contracts, but it still has to run the gauntlet of the Conservation Board and, perhaps, the Public Utilities Board after that. Mr. MacKimmie hasn't everything at the moment. Peaking gas is the problem of distributing gas in Alberta?

MR. WILLSON: It is one of the major problems, yes.

Q. One way of looking after your peaking

gas is by curtailing or discontinuing service to your industrial consumers?

MR. WILLSON: That is correct.

Q. That is because theyhare now on an interruptible contract?

MR. WILLSON: No, they are on a firm gas contract but it has been suggested, perhaps, they should be put on an interruptible basis. We do not think that is a sound thing to do in this country where we do have so much gas.

Q. Where we do have so much gas -- you are having a lot of trouble in finding peaking gas?

MR. WILLSON: No, sir, we have not had. We are having trouble impressing the City of Calgary that it is necessary.

Q. If you do not mind my saying so, I will call that trouble for the time being. If you are having trouble with that, I am going to make the suggestion which you might understand, coming from me -- there is an industry operated out here, Consolidated Mining and Smelting Company -- do they take much gas from you?

MR. WILLSON: 11 million cubic feet a day.

Q. That would go quite a long way to supplying your peak load on a cold day?

MR. WILLSON: The present peak of Canadian

Western is 240 million cubic feet a day, so that 11 million feet would be 5 per cent. of the total.

Q. Have you some other people who are anything like Consolidated Mining & Smelting?

MR. WILLSON: There is a cement plant at Exshaw which is about the same size. We supply about 30 million cubic feet a day to industrial customers.

Q. If you curtailed or put them on an interruptible basis, to what extent would it solve your peaking problem in Calgary?

MR. WILLSON: It would postpone the necessity of getting an additional peaking source for about two years. It would take about two years for the domestic and commercial market to grow to the point where we would have to have any additional firm winter gas.

Q. You have not had a policy of curtailing or discontinuing those large industrial customers you have just talked about?

MR. WILLSON: No, sir. In emergency circumstances we have had to interrupt service. We had to do that last winter on one occasion when power failure took out the Jumping Pound plant, and we had to ask them to cease using gas until this emergency was over, but that is strictly an emergency arrangement, but as a matter of engineering planning we feel it is proper to design and

complete a system to be in a position to supply the total co-incident demand of our customers on any particular day.

Q. You mean to say you think you should not have this interruptible arrangement at all?

MR. WILLSON: We do not think it is a proper arrangement in this country at all. It is not an economic thing for the customer himself. The gas rates are so low now for firm gas that there is not enough room to reduce them further to the point that the customer can afford to put in the stand-by heating facilities in order to get over these periods of interruption. It is just a matter of economics; the cost of the peak shaving fuel in regard to pay gas rates for firm gas supplies.

Q. You say you do it now, if you have to, on an emergency basis, but you do not want to do it as regular policy, and that is why you want more dry gasfields to look after your peaking?

MR. WILLSON: Yes, we think it is the proper way and that is the way the consumer wants it. He does not want to be interrupted.

Q. Under this Alberta Southern scheme you do not ever expect to have to take any peaking gas from them, and you do not expect to take any base load gas from them until 1964 to start with?

MR. WILLSON: In the case of the Canadian

Western Company that is, generally speaking, the situation. I do not think we should say we never expect to take peaking gas; we may have to, but in the foreseeable future we do not expect to take peaking gas from them.

Q. How about Northwestern Utilities? Do you make any distinction in their case?

MR. WILLSON: Yes, we do. As was mentioned earlier, Northwestern will be building a pipeline from the Pembina field into Edmonton this year, and it is expected that there will be about 65 million cubic feet a day of oilfield residue gas for sale in the field starting about the first of November of this year. Now that gas is actually under contracts, is covered by contracts between the producers in the field, some 75 per cent. of the producers and Alberta and Southern. Northwestern proposes to buy this Pembina gas until such time as the Alberta and Southern project gets underway and if it never gets underway, then Northwestern will continue to buy Pembina gas indefinitely. However, once the Alberta and Southern project does get underway, our studies indicate that Northwestern will buy 50 million cubic feet of base load gas from Alberta and Southern starting in the year 1961 through the Edmonton Company, so it is much more imminent that base load gas will be delivered.

Q. You say the base load gas contracts

have been negotiated for the reason you have just indicated: because of the contracts with Edmonton?

MR. WILLSON: We feel that supplies have to be augmented as near as possible to Calgary.

Q. Just going back once more to the questions Mr. Pattillo was putting to you about these, what I call "orphan" fields: suppose Westcoast does not get a permit to export. That would leave one or two rather sizable fields which they have tied up without any market,and what would be the attitude of your companies then towards this field?

MR. YORATH: We will write them a letter of introduction to Alberta and Southern.

Q. You put Savanna Creek, for instance, into Alberta and Southern.

I just have one more question, Mr. Willson, about this appropriate transmission charge. You told me that would be a charge, if it ever comes into being at all, that would be a charge which would be paid, actually, to Alberta Gas Trunk. Would the load factor at which the gas was being delivered to you have anything to do with making that charge more or less?

MR. WILLSON: We would expect that the higher the load factor, the lower the unit tariff would be.

Q. So that if the load factor was not very high, that premium, or, as it is called, appropriate transmission charge, might be a considerable item?

MR. WILLSON: You are talking about gas for strictly peaking purposes?

Q. Just whenever you have to pay that appropriate transmission charge, which is when you are buying peak gas or when you are buying base load gas too -- in each instance you have to pay -- and you have committed yourselves to pay an appropriate transmission charge: you are telling me that the load factor might enter into that, and would you mind explaining that?

MR. WILLSON: I think possibly we could explain it best by reference to Tab S, page 4, at the bottom of the page.

Q. Yes, I am accepting from you the fact that if you take it on a high load factor it would be X cents, but on a low load factor it would be X cents plus something?

MR. WILLSON: That is right.

Q. Well, that is what I am concerned about, and I am putting to you that if, as and when you do take it or have to take it on a low load factor basis it might become an appreciable charge?

MR. WILLSON: Yes, looking at the 30-inch pipe line example, if we take it on a 100 per cent

load factor the cost would be 1. cents per 100 miles carried On a 40 per cent load factor the tariff would be 2.5 cents per 100 miles carried.

Q. Are you looking at the 30-inch pipe line as the practical one, or should you be looking at the others?

MR. WILLSON: I chose the 30-inch because that is the proposed size of the facilities; the main facilities are 30-inch and 36-inch.

Q. All right. Well, that is a perfectly good reason for taking it. You could pay as much as $2\frac{1}{2}$ cents for 100 miles?

MR. WILLSON: Yes.

Q. On a 40 per cent load factor basis?

MR. WILLSON: Yes.

Q. I am instructed that might make a quite a difference -- that might run into quite a lot of money, that would ultimately have to be paid by the consumers -- customers of your companies?

MR. WILLSON: Well, we would only do that if that were a lower cost supply than some other source that was available. In other words, we would examine the alternatives of buying peak load gas under this contract as compared to going out and developing peak load gas elsewhere, and compare the cost of the two delivered to the market, and we would naturally select the lower cost alternative; but, I think the companies have to be prepared to pay the cost

associated with the service. In other words, if Trunk Line did perform a transportation service for us on a low load factor, they are entitled to recover the costs of that operation from us.

Q. I might just leave that by saying that, as you have already told me, that provision as well as all other provisions has to be examined and passed upon by the Conservation Board?

MR. WILLSON: Yes.

MR. FRAWLEY: Thank you very much, Mr. Willson and Mr. Yorath.

THE CHAIRMAN: Gentlemen, we will break now for ten minutes until three-thirty.

---Short recess.

THE CHAIRMAN: Gentlemen, we will resume our hearings. Mr. Helman, have you any questions that you would like to ask?

MR. HELMAN: Yes, I have a few, if you don't mind, Mr. Chairman.

BY MR. HELMAN:

Q. Mr. Yorath, both of the utility companies are controlled by International Utilities?

MR. YORATH: That is correct.

Q. That is an American company with its headquarters in New York?

MR. YORATH: Right.

Q. And you are the president of both these companies, and Mr. Milner is vice-president of both utilities companies?

MR. YORATH: Mr. Milner is chairman of the companies.

Q. Chairman of the Board?

MR. YORATH: Chairman of the companies. He is not chairman of the board; he is chairman of the companies.

Q. That is a subtle distinction I don't understand.

MR. YORATH: Neither have I been able to.

Q. But both of you are also directors of International Utilities?

MR. YORATH: Correct.

Q. And both of you are now directors of Alberta and Southern Gas Company?

MR. YORATH: Correct.

Q. And when Mr. Willson was discussing the at arm's length negotiations carried on between the two companies, who carried on those negotiations?

MR. YORATH: Present at that meeting were, if my memory serves me correctly, Mr. Milner, Mr. Willson and myself on one occasion, and at another meeting, Mr. Snider of our company was present. I think that is all.

Q. Who was present for Pacific Gas and Electric?

MR. YORATH: For Pacific Gas and Electric as well?

Q. Yes.

MR. YORATH: I can't remember them all. Mr. Norman Sutherland, the president of the company, was. Mr. Bolton was, the vice-president; and Mr. Peterson, their counsel, and there were probably two or three others, but I can't remember.

Q. When you say these negotiations were carried on at arm's length, I suppose you and Mr. Milner withdrew from them because you were represented on both companies?

MR. YORATH: I beg your pardon?

Q. I suppose you and Mr. Milner withdrew from the negotiations because you were represented on both companies -- on Alberta and Southern, which is one party to the agreement -- and you were also on the two utility companies?

MR. YORATH: Alberta and Southern, I don't believe -- whether it was fully incorporated or not, I don't know, but my recollection is that at the time these meetings took place in New York that Mr. Milner and I were not on the board of Alberta and Southern -- in fact, that is so.

Q. When did you go on the board?

MR. YORATH: I can't tell you the exact date. It was either -- yes, it was June; the latter part of June, 1957.

Q. The agreement itself is dated August, 1957.

MR. YORATH: Yes, that is when it was signed.

Q. So, when it was executed you were both on both boards of directors?

MR. YORATH: Yes.

Q. You at no time, until Westcoast Transmission gave its evidence in the witness box at the hearing before the Conservation Board quite recently, made any approach to Westcoast in connection with obtaining an agreement from them?

MR. YORATH: No. I heard of this agreement that Westcoast was proposing for our protection, or the protection of the Alberta consumer, and I suggested to one of the officers of, I think, Pacific Petroleum that if they felt free to do so it may be a nice idea to let us see the copy of the agreement, and Mr. Hetherington very kindly provided us with copies of the agreement.

Q. When was that?

M. YORATH: My memory would be that it was a few days before the hearing.

Q. And as I understand Mr. Willson, your chief objection to that agreement was that you had to, first of all, get your reasonable supplies from other sources, or the other sources which might reasonably supply you -- I forget the precise language:

the other sources available to you from which you might reasonably get supplies?

MR. WILLSON: Our chief objection is, it is very indefinite both as to volume and price.

Q. As to volume and price?

MR. WILLSON: Yes.

Q. Well, he did give a price in the witness box, saying he would supply any amount of gas at that price. Did you hear that? Mr. Hetherington said that.

MR. WILLSON: He gave some evidence as to the estimated cost of gathering gas from certain fields in the Calgary area, but he didn't say that that would be the price in the contract.

Q. Well, I asked him quite definitely what price he would supply it at, and he said he would supply it at 14 cents, is my recollection, to anyone that came up and asked for it.

MR. WILLSON: That is not my recollection.

Q. What is your recollection?

MR. WILLSON: My recollection is that he outlined the Westcoast estimate of the cost assuming buying the gas at 12 cents. As I recall, the cost worked out to something a little greater than 18 cents, and then there is provision in the base gas purchase contract for escalation of the 12-cent price so that any year down the road the price would be somewhat higher than 18 cents.

Q. As I understand it, you don't object in any way to Westcoast's suggestion that you have to, first of all, get your supply from such sources as are reasonably available to you?

MR. WILLSON: Our objection is the lack of definition of the word "reasonable", but we think that the supplies for Calgary should come from the most economic sources to the City of Calgary.

Q. Do you think there is anything more economic than a field six miles from the City of Calgary?

MR. WILLSON: For what purpose?

Q. For getting gas for Calgary?

MR. WILLSON: For peak load gas?

Q. I am not talking about that. I am talking about your ordinary base load gas.

MR. WILLSON: I think the Westcoast submission, which indicated that that gas would cost of the order of 18 cents at a point six miles from Calgary, indicates -- it doesn't follow that that is the cheapest gas to the City of Calgary.

Q. You don't think you could bargain with Westcoast to have them meet any price that Alberta and Southern have, without the additional transmission cost of Alberta and Southern?

MR. WILLSON: No, I think you would have to compare one source of supply with the other before you can say one is less costly than the other.

Q. In any event, you have not been carrying on any such negotiations with them?

MR. WILLSON: In June of last year we attempted to enter into a contract with the Jefferson Lake Sulphur Company for the East Calgary gas, but they decided to enter into a contract with Westcoast rather than us.

Q. But, at the same time, that would not have prevented you from making an agreement with Westcoast, would it?

MR. WILLSON: No, and we are not opposed to entering into an agreement with Westcoast, providing it is a proper agreement and provides the necessary safety factors.

Q. But you have not carried on any negotiations for that purpose?

MR. WILLSON: No.

Q. Looking at the Pembina field near Edmonton, you have just built -- how long a line is it from Edmonton to Pembina?

MR. WILLSON: We are proposing to build a line in 1958; it is about a 70-mile line.

Q. What is it going to cost you?

MR. WILLSON: It is around $3\frac{1}{2}$ million.

Q. And then will it have to go on to the Viking-Kinsella field for storage purposes?

MR. WILLSON: We will use our own existing facilities to carry gas in the summer time from

Edmonton to Pembina.

Q. You won't need the new pipe line for that?

MR. WILLSON: No.

Q. But you are not buying any gas from the Pembina producers: you are buying it from Alberta and Southern; is that it?

MR. WILLSON: That is technically correct.

Q. Because I observe in the Alberta and Southern brief they say they have tied up over 80 per cent of the producers in the Pembina field, and are expecting to tie up the rest of them. So, you are dealing with Alberta and Southern entirely with regard to the Pembina field?

MR. WILLSON: That is correct.

Q. Why have you interposed Alberta and Southern between yourselves and the Pembina field producers?

MR. WILLSON: That seemed to be the convenient way to handle the situation.

Q. What was convenient about it?

MR. WILLSON: They had the organization to negotiate with 75 different suppliers, and we don't have.

Q. So that you fell down in your negotiating personnel; is that it?

MR. WILLSON: We didn't fall down; we just didn't have that many people.

Q. You don't have any people, do you, for negotiating -- you couldn't negotiate with Westcoast, and now you can't negotiate with Pembina producers?

MR. YORATH: We have people for negotiating, who do carry on negotiations continuously.

Q. I see.

MR. YORATH: But in this particular instance it was more expeditious for our company to deal with Alberta and Southern.

Q. What was the expedition about it?

MR. YORATH: Because we had a staff whose time was better spent devoted to the operating of our companies.

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Q. In any event, you didn't carry on the negotiations?

MR. YORATH: We didn't carry on the negotiations with the Pembina operations, but we were present at some of those negotiations.

Q. So now we have Alberta and Southern in control of the Pembina production?

MR. YORATH: That is true. I am just correcting my colleague here.

THE CHAIRMAN: Just a moment, Mr. Helman.

MR. HELMAN: I thought he had already been corrected.

MR. YORATH: Not so that you could hear the correction.

MR. WILLSON: I do not think it is correct to say Alberta and Southern is in charge of the Pembina production.

Q. Why don't you think that? They have got the agreement, haven't they?

MR. WILLSON: The producers in the field regulate the Pembina production and the supply of the gas is a matter of crude oil production, which, in turn, is regulated by the Alberta Conservation Board.

Q. But when you get to the question of the plant that extracts the oil and the other products that come out of it, it is really the property of Alberta and Southern, which, in turn, is

turned over to you?

MR. WILLSON: That is correct; subject to all the laws and regulations of the Province.

Q. Oh, naturally.

Now, would you just turn, Mr. Willson, to what you have under Tab P here with regard to the reserves in billions of cubic feet, page 1. Now, you explained to Mr. Pattillo this morning, taking the bottom half of those figures, that when you took associated gas, which is broken up into two parts, solution gas and gas cap gas, that both of those depended, in turn, on the production of oil.

Now, I want you to turn your attention, for a moment, to what I call the sour gas oil. That, in turn, depends on the production of sulphur, does it not, Mr. Willson?

MR. WILLSON: Well, are you speaking in the total sense or of any one field?

Q. In any field where you have sour gas.

MR. WILLSON: In the case of, for example, Jumping Pound, the Jumping Pound field, the production of that field is tabled to the sale of gas, not the production of sulphur.

Q. Well, that has not got a great quantity of it, such as we have in the other sour gas fields, running up to one-third of the hydrogen sulphide.

MR. WILLSON: No, it doesn't have as large

a percentage.

Q. When you get into this field with large percentages of sour gas, some arrangements have to be made and seen to that there is a market available for the sulphur of these?

MR. WILLSON: I imagine that would be a major concern to the producer.

Q. And, therefore, it is just as much dependent on the production of sulphur having a market as the production of oil has to have a market?

MR. WILLSON: I am not a student of the sulphur business. I don't know.

Q. You have not given any attention to that?

MR. WILLSON: No.

Q. And you don't know what percentage of the sour gas makes up this 5,177 billion cubic feet?

MR. WILLSON: You mean the percentage of the very sour gas?

Q. Yes.

MR. WILLSON: I don't know what that is indicated as.

Q. Now, just dealing, for a moment, with the Carbon field, because it has been dealt with extensively here: your companies have not acquired the whole of the Carbon field, have they?

MR. WILLSON: No, sir.

Q. What contracts have you made for it?

MR. WILLSON: We have three firm arrangements; one with the Shell Oil Company.

Q. Yes?

MR. WILLSON: One with the Tennessee Gas Transmission and one with Mobiloil of Canada.

Q. How much of the available gas area do those cover, relatively to the total?

MR. WILLSON: We estimate that covers about 60 per cent. of the total reserves.

Q. If your reserves were 60 per cent. that you have for peaking purposes, the persons who own the other 40 per cent. can exhaust that field, can't they?

MR. WILLSON: I wouldn't think they could.

Q. Isn't the production there through the porous zones permeable?

MR. WILLSON: I wouldn't think they would be allowed to exhaust it.

Q. You don't think they would be allowed to exhaust it?

MR. WILLSON: No.

Q. You think they would be stopped and forced to keep it in the ground until you require it, is that it?

MR. WILLSON: No. I think, if they had a market -- before we go into this, I might mention that of the other 40 per cent. probably close to

half of it is in Crown reserve land and, as such, is owned by the Province of Alberta; so we will probably be talking about, maybe, 20 per cent.

Q. The other 20 per cent. might be put up for sale, too, might it not?

MR. WILLSON: Yes; but as things stand, at the moment, there is probably only 20 per cent. that might possibly be marketed to the other pipelines, if there were pipelines in the vicinity, and I would think those producers would be allowed to produce only their 20 per cent. of the share of the field and then it would be deemed that they had produced their share of the total and the balance would be then owned by the company.

Q. Well, that is just a guess on your part?

MR. WILLSON: Well, the Oil and Gas Conservation Act sets out very clearly the responsibilities of the Board with respect to matters of equity.

Q. I understood from you your whole policy was for free enterprise and you didn't want anybody getting any gas in the ground; and here you are suggesting these people will be allowed to exhause only part of the gas.

MR. WILLSON: We are suggesting they be allowed only to take their part of the gas, their share of the gas; not their share and somebody

else's.

Q. Well, you might take their share.

MR. WILLSON: No, that is not our policy.

Q. Well, it may not be your policy, but you might do that.

Well, let us pass on to another picture about this. Is any part of this field probably going to be taken by Trans-Canada?

MR. WILLSON: Not that I know of.

Q. You haven't heard about that?

MR. WILLSON: No.

Q. Your information probably has not come from the same sources as mine has.

Can you use a field as a storage field unless you own the whole of it?

MR. WILLSON: I think it is logical that the entire field should be unitized and put under one operation and, as such, controlled by the unit, it would be single control.

Q. At the moment you don't know that that can be done or will be done?

MR. WILLSON: No. It would be our objective to work towards that end.

Q. And, therefore, the suggestion that Carbon can be used as a storage field has that difficulty involved in it?

MR. WILLSON: That is correct.

Q. I want you to look, for a moment,

at the prices that are being paid by the Alberta and Southern for gas. I have in front of me here the Alberta and Southern Gas Company's contract with Imperial Oil Limited. The schedule of prices that is being paid starts this way: on the 30th of June, 1961, the schedule requires 13.50¢. The next year it goes up to 14.50; the next year it goes up to 15.25 and, by the time we reach June 30, 1965, we are up to 16.25. It keeps going up, in similar increments.

By the way, when do you think you are going to start taking gas that you require from Alberta and Southern? I think you gave the date as 1964, didn't you?

MR. WILLSON: Yes, that is as we see the earliest possible date.

Q. And at that time the price will have gone up to 16.25; and, ultimately, it goes up, in 1983, to 21 per MCF.

All those prices will be reflected in what is charged the Calgary consumer?

MR. WILLSON: If we buy gas from Alberta and Southern.

Q. If you buy gas from Alberta and Southern and, if you are paying the competitive price to other purchasers?

MR. WILLSON: That is right.

Q. In addition to that, there is what

you explained to Mr. Frawley were appropriate transmission charges. First of all, there is a charge that the grid system is going to lead to, that's right, isn't it?

MR. WILLSON: Yes, if their facilities are used, they will have to charge for their proper share.

Q. Well, the facility you are going to be using, so far as the grid system, is the facility of Alberta and Southern, using that pipeline and your taking part of it?

MR. WILLSON: It could be quite possible, though, Mr. Helman, for example, that Sarcee, the Sarcee field, if the Alberta and Southern line is built here (indicating on large map) that our existing pipeline from Jumping Pound can come directly in here and there would be no tariff.

Q. You will not be getting that production from Alberta and Southern, will you, from Jumping Pound?

MR. WILLSON: No, from Sarcee.

Q. Well, Sarcee, really, should have been reserved for the Alberta consumers, should it not?

MR. WILLSON: By whom?

Q. I beg your pardon?

MR. WILLSON: Reserved by whom?

Q. Well, you can use the Sarcee gas just as fast as Alberta and Southern can, can't you, if

you follow the system which Mr. Davies suggested by running it down through the Madison plant?

MR. WILLSON: No, sir. The Alberta and Southern contract, as I recall, provides, using the year 1962 as an example, the contract volume in the Alberta and Southern contract is 61 million feet a day and the Alberta and Southern has to ---

Q. Well, the contract volume with whom?

MR. STEER: Please let the witness finish.

MR. HELMAN: I just want to know whom he is talking about.

MR. WILLSON: Between the Shell Oil Company and Alberta and Southern, the contract volume for Sarcee, the Sarcee field, is 61 million feet a day; and Alberta and Southern is obligated to buy gas at a 90 per cent. load factor; so, in the course of a year, Alberta and Southern would buy something over 20 billion feet, and Mr. Davies' suggestion, for the same year, was that Sarcee would produce 3 1/2 billion feet or about one-sixth the volume contemplated in the Alberta and Southern contract.

Q. You mean to say this one well is going to produce anything like those figures you have indicated to me?

MR. WILLSON: There will be a lot more than one well existing at that time.

Q. I see. Therefore you, representing the two utility companies, do not think that field

should have been reserved for Calgary; that is your honest opinion, Mr. Willson, is it?

MR. WILLSON: We do not think that is a proper device to use in protecting the local consumer.

Q. You have no hesitation in saying that, in order to protect your companies, Westcoast could make certain provisions in its agreement with you providing it gets an export permit? That is right in your submission that I read here. That is correct, isn't it, Mr. Willson?

MR. WILLSON: Yes, we don't consider the Westcoast contract as a suitable protection for the Alberta consumer.

Q. But you said, in here, that if the Westcoast is going to get a permit to export, you want provision made in your agreement that they have to give you the same kind of agreement that Alberta and Southern gave you, that's right, isn't it?

MR. WILLSON: That is correct.

Q. Therefore, I am suggesting to you that there is no reason why, if Alberta and Southern gets a permit, that it should not permit this particular gas to go for the citizens of Calgary as part of the right to export?

MR. WILLSON: I don't follow you, Mr. Helman.

Helman.

Q. Well, just come a little closer to me and perhaps you can see me in the dust here.

Looking at the Sarcee field and its distance from Calgary, it is a natural source of supply for Calgary. Will you go that far?

MR. WILLSON: Yes, if the Calgary market were big enough to absorb gas from that field, it certainly is.

Q. Well, let us assume it is big enough, without your having to get Carbon into the picture, at the moment.

Isn't it just reasonable that this Board, before granting export permits, should say to Alberta and Southern that, as part of the conditions under which the permit will be granted, the Sarcee field be turned over to Calgary?

MR. WILLSON: No, that is not our submission.

Q. I did not say it was your submission. I say: Is it not as reasonable as your suggestion that Westcoast would have to make an agreement with you?

MR. WILLSON: No, I do not consider it in the same category at all.

Q. Representing the consumers of this district you do not think so, Mr. Willson?

MR. WILLSON: No, I do not think that it is proper to expropriate a field for a municipality.

Q. Well, it is not being expropriated?

MR. WILLSON: Well, it certainly is if it is not allowed to be produced in a competitive market, but rather it has got to be shut in and produce in small amounts until the market is large enough to take it.

Q. Well, Alberta and Southern has not bought any fields, has it?

MR. WILLSON: It has bought the gas in the ground.

Q. Yes. It has not bought any fields. All it has done is it has gone around and made a lot of contracts with different owners?

MR. WILLSON: That is right.

Q. And your company could just as well make contracts with owners?

MR. WILLSON: No, sir.

Q. Why not?

MR. WILLSON: We have not got the market to offer.

Q. You have not got the market to offer?

MR. WILLSON: No.

Q. And, therefore, you could not make any deals with any others?

MR. WILLSON: Not of the type that Alberta and Southern has made.

Q. Not of that type?

MR. WILLSON: No.

Q. But they do not own any gas in the ground?

MR. WILLSON: I am not suggesting that they do.

Q. Yes, and they have not had to buy any fields to get this export right, have they?

MR. WILLSON: Their market is of a type that they do not need to provide special peaking facilities.

Q. Just let us come back to these special peaking facilities. Alberta and Southern and its associated company, Pacific Gas and Electric, have plenty of fields in the United States in which to store gas, have they not?

MR. WILLSON: I do not know.

MR. MacKIMMIE: I think I must say in all seriousness that Alberta and Southern will have a witness here. I do not think it is quite fair to

ask a witness from another company to discuss policy matters that concern my client.

MR. HELMAN: I am not asking about policy matters that concern your client. I am asking about these peaking facilities, and this witness is going to spend --- how much money are you going to spend on the Carbon field?

MR. MacKIMMIE: Then, I must have misunderstood the question, Mr. Chairman.

THE CHAIRMAN: I understood the question -- although we can get it from the record, Mr. MacKimmie -- was as to what storage fields Pacific Gas and Electric had in the United States.

MR. MacKIMMIE: Yes.

MR. HELMAN: Q. You have not made any investigation?

MR. WILLSON: No.

Q. You do not know a thing about it? You are completely blank on that subject? Let us see what you are spending on the Carbon field just for a few minutes, and I will be through with you, Mr. Willson. How much has the pipe line cost?

MR. WILLSON: About $3 million.

Q. How much are you paying to these companies that you have the 60 per cent deal with?

MR. WILLSON: We estimate that we can acquire the total gas reserves in Carbon for a little over $5 million.

Q. Yes. Just come down to the 60 per cent that you have already. How much money is that? Is that the $5 million?

MR. WILLSON: No, it is about $3.9 million.

Q. $3.9 million; roughly $4 million. How many wells do you have to drill on this property?

MR. WILLSON: There are six wells existing there now, and they are sufficient to meet our requirements for quite a number of years. Ultimately we think there will be, probably, in the order of 12 to 15 wells.

Q. That is the sum total of all that is going to be drilled on your acreage?

MR. WILLSON: In the total acreage of the field.

Q. Twelve to fifteen wells?

MR. WILLSON: Yes.

Q. How many wells per section is that?

MR. WILLSON: About one.

Q. One well per section?

MR. WILLSON: Yes.

Q. And you think that is sufficient to exhaust the Carbon field, do you?

MR. WILLSON: We think it is sufficient to develop the deliverability that the company requires.

Q. Even though the other 40 per cent is drilled more definitely than that?

MR. WILLSON: What other 40 per cent?

Q. The 40 per cent that you have not acquired?

MR. WILLSON: We have offers out for that 40 per cent.

Q. I know, but you have not got it yet. Western Leaseholds will not sell to you, will they?

THE CHAIRMAN: I do not think that is a fair question, Mr. Helman.

MR. HELMAN: Well, it is a fact.

THE CHAIRMAN: I do not think it is of interest to us.

MR. HELMAN: I see. The Board can not take judicial notice of that.

Q. Can you tell me, assuming you are taking gas from Alberta and Southern for the use of Calgary citizens, exactly what your transmission costs are going to be?

MR. WILLSON: I do not know what they will be, Mr. Helman. They will be whatever is appropriate for the service that the trunk line provides.

Q. And you have no estimate of that? You have no idea of what it is?

MR. WILLSON: I imagine it will be two or three cents a thousand.

Q. Per 100 miles?

MR. WILLSON: I would say in total 2 or 3 cents a thousand.

Q. Because the figure I got from Mr. Mahaffey, in discussing it with him the other day, was 4 cents.

MR. WILLSON: That is the price that Trans-Canada is to pay to Trunk Line for gas transported from all over the province to the Saskatchewan border.

Q. I see, and you think this will be cheaper?

THE CHAIRMAN: Is not all this hearsay -- what Mr. Mahaffey told you -- Mr. Helman?

MR. HELMAN: What Mr. Mahaffey told me is hearsay, but I want the witness to say. He has signed a contract in which he says he is going to pay appropriate costs for transmission, and I want to find out how closely he knows the figure. He is the expert from this company, and he knows it, sir.

THE CHAIRMAN: He said 2 or 3 cents.

MR. HELMAN: Then, I want to know if that is his complete knowledge.

Q. Will you have to have a line from the Alberta Trunk Line to wherever you are going to discharge the gas?

MR. WILLSON: Do you mean from the Trunk Line to the City of Calgary; to the market itself?

Q. Yes.

MR. WILLSON: Yes, it will be necessary

to provide those facilities.

Q. How long a line is that?

MR. WILLSON: Well, it would be probably of the order of 15 or 20 miles.

Q. What size line will that be?

MR. WILLSON: I do not know, Mr. Helman.

Q. You do not know?

MR. WILLSON: No.

Q. And you have no idea of what that transmission will cost?

MR. WILLSON: Well, it be a small amount.

THE CHAIRMAN: Thank you very much, Mr. Helman.

I wonder, Mr. Yorath, if you could help the Commission in regard to some of the references in the brief and the answers to some of the questions. I would like to get back to this question of overall reserves with which we are deeply concerned, and I must say, if my fellow Commissioners feel the same way as I do, we are all completely confused. If you look at page 1 of Tab P you will find your figure of 17.7 billion cubic feet. From that, as I understood it this morning, you really -- possibly not taking the whole of it, but you estimate that 5 trillion cubic feet will not be developed because it must await the oil development, and that is the solution and gas cap gas. Is that a fair statement?

MR. YORATH: Yes, sir.

THE CHAIRMAN: And then you ---

MR. YORATH: Well, it may be produced in part, of course.

THE CHAIRMAN: It may be produced in part -- I quite understand that -- but let us take it that it is not produced in the 30-year period for the moment, which is a very conservative estimate, I realize. Now, you have 3 trillion cubic feet under the control of the two utilities?

MR. YORATH: That is right.

THE CHAIRMAN: And you need another 4 trillion cubic feet for additional supplies?

MR. YORATH: Yes, sir.

THE CHAIRMAN: That is a total of 7 trillion. If you deduct the 5 trillion from 17 trillion you come down to 12 trillion, roughly, and taking your 7 trillion from that brings it down to 5½ trillion, according to the figures I have here, and that includes any gas for which there has already been given an export licence from the Province of Alberta. My understanding is that there is something like 6 trillion feet which is permitted to be exported over the next 20 years from the province, and yet on this calculation I come up with five and a half trillion that can be exported in the next 30 years. Would you explain that?

MR. YORATH: I think, sir, that associated

gas -- that is, solution gas and gas cap gas -- has been phased into the long term picture in the granting of the export permits. Mr. Willson will correct me in that if I am wrong, but that is my understanding. It is deemed to be somewhere down the road in that 30-year period. It is not available now.

THE CHAIRMAN: But that might not turn out to be the case; is that right?

MR. YORATH: It conceivably might not, I suppose.

MR. WILLSON: I think, sir, it would be safe to assume that all of the first category -- that is, the solution gas -- will be produced in the 30 years. It is being currently produced, and I think it is reasonable to assume that those oil fields currently being produced will produce that amount of gas in the 30-year period, but then we will be getting into the era where the gas cap gas will be available.

THE CHAIRMAN: That would add 2 trillion feet?

MR. WILLSON: Yes.

THE CHAIRMAN: That would more than take care of the deficiency on these figures. Now, in regard to the availability of exportable gas these permits are for the next 20 years whereas these figures are based on 30 years. Is that correct?

MR. WILLSON: Yes.

THE CHAIRMAN: Should you cut them down by one-third for 20 years?

MR. WILLSON: You are referring to the ---

THE CHAIRMAN: I am referring to the whole total of 17 trillion when related to a 30-year term as gainst permits for export over 20 years. Where do they match up? Do you know? Can you help us on that?

MR. WILLSON: Well, it is my recollection that the export permits are roughly in the order of 25 years, and I think they total, as you mentioned, about 6 trillion cubic feet. I agree with your estimation of the situation, sir, based on the assumptions you have made that the oil field gas should not be taken into account. There just is not any gas available for further export on that assumption.

THE CHAIRMAN: May I take you, then, to the bottom of page 26 of your brief, and I will read it; it is the last paragraph: "It seems inevitable that if we wish to have our gas resources developed, we must also have export of gas in sizeable volumes." Then on page 27 you refer to the potential reserves of the province as reported by the Conservation Board in its report of January 31st, 1957, which is, as I understand it, the last report of that nature made by the Board,

and the last sentence of that -- that is, I take it, a volumetric basis of estimation -- in the last sentence you say: "Assuming that the Board's estimate is a reasonable one, it would appear that substantial quantities of gas could be exported from the province without the local supply being endangered."

Now, in one sentence you have used the words "we must also have export of gas in sizeable volumes", and then "substantial quantities of gas could be exported". Has your organization made any estimate of just how much can be exported?

MR. WILLSON: No, we have left that up to the Provincial authorities.

THE CHAIRMAN: Well, then, sir, what is the basis of your saying that substantial quantities of gas could be exported, and "We must have sizeable quantities of gas exported if the resources are to be developed", and at the same time recommending that on every occasion when an export permit is being considered, the proposed exporter shall establish that in addition to any quantities the export of which is requested there is a sufficient supply to meet the requirements of the distributors for a rolling period of not less than 30 years? Now, the rolling period -- I am not trying to cross-examine you, but I want to be enlightened on this -- the rolling period has been referred to as on site

gas, and so on, here today, but just what does that 30-year rolling period mean when related to the estimate of available proven gas reserves of 17 trillion cubic feet? According to my understanding, that estimate is also for a 30-year period.

MR. WILLSON: 17 trillion cubic feet?

THE CHAIRMAN: Yes.

MR. WILLSON: Well, the 17 trillion resulted from the Board's study of proven reserves, which is now fifteen months old.

THE CHAIRMAN: I realize that. Let us take the figures as of 1957, as of the date when this was made, because it is the last estimate of available proven reserves given by the Board, as I understand it.

MR. WILLSON: Yes, except the estimate that they filed in the last week.

THE CHAIRMAN: Yes, which, it was very carefully said, was an estimate made by the staff and not by the Board. It was not an official Board estimate.

MR. WILLSON: Well, dealing with your question relative to page 27, we made that concluding statement there on the assumption that there will be ultimately 75 trillion cubic feet of proven gas, and that provincial requirements of 7 trillion cubic feet and authorized export of 6 trillion cubic feet -- that is a total of 13 trillion cubic feet --

leaves 62 trillion cubic feet to be disposed of somewhere down the road in the next one hundred years or something like that. In other words, the statement on page 27 does not relate to the proven reserves as given on page 1 under Tab P, but rather it relates to a longer looking at it, and examining the picture in the light of trends and discoveries and development.

THE CHAIRMAN: You have made no study in your organization as to what quantities would be available for export?

MR. WILLSON: No, we have limited our study to the best method of looking after the 30-year requirements of the province, and have left that bigger problem to others.

THE CHAIRMAN: Well, it certainly seems like quite a problem. Now, going back to another point for just a moment, I do not know that I quite understand one or two things that were said by you, I think, Mr. Willson -- I did not quite hear -- in regard to the Foremost field which is down to the southeast of Calgary. Is it towards the ---

MR. WILLSON: Yes, I think this represents the Foremost field, and there should be a red line joining in here (indicating on map).

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THE CHAIRMAN: I think it was Mr. Helman who asked Mr. Yorath the question of what would happen if Alberta and Southern didn't get an export permit and Westcoast did, or vice versa, and you said you would send the producers a letter of introduction to the other: what would happen if neither one got an export permit?

MR. YORATH: That was not in relationship to the Foremost field.

THE CHAIRMAN: Let us hold that for a moment and get back, because it is much the same sort of problem in my mind.

MR. YORATH: If neither one got a permit?

THE CHAIRMAN: Yes?

MR. YORATH: Well, I suppose that would be dedication of the reserves to our market.

THE CHAIRMAN: Would the contract that you have with Alberta and Southern still hold?

MR. YORATH: If they were not successful in getting a permit?

THE CHAIRMAN: Yes.

MR. YORATH: I can't conceive of how it could. In the case of Pembina -- I am not digressing -- but in the case of Pembina it would, because that is assigned to us, but I think otherwise the contract would become null and void.

THE CHAIRMAN: In other words, the contract between yourselves and Alberta and Southern

is conditioned upon Alberta and Southern getting an export permit?

MR. YORATH: Yes, sir.

THE CHAIRMAN: Well, you explained, or Mr. Willson explained, coming again to the Foremost field, that that was not taken into the Alberta and Southern holdings or purchase agreements for gas; is that right?

MR. YORATH: The Foremost field is a very small field of ours, which we wholly control.

THE CHAIRMAN: Do you own it?

MR. YORATH: Oh, yes.

THE CHAIRMAN: You own it?

MR. YORATH: Yes.

THE CHAIRMAN: I see.

MR. YORATH: And we connected them to our system way back.

THE CHAIRMAN: Well, that answers my question.

MR. YORATH: Are you referring to Savannah Creek?

THE CHAIRMAN: No, to Foremost, because that is where it came up in the evidence.

MR. YORATH: Foremost? The only reference I have made to it was on page 6 of our brief, pointing out it was tied in in the years between 1923 and 1953.

THE CHAIRMAN: Yes, but it did come up

this afternoon.

MR. PATTILLO: In connection with the Turin field.

THE CHAIRMAN: Yes, but if you own the field, I take it that is a different matter. I was wondering what would happen to producers in that area. Mr. Willson has said no gas would be taken out for seven or eight years.

MR. YORATH: That is the Turin field: we don't own that field.

THE CHAIRMAN: Well, what does happen to these producers?

MR. YORATH: At the present time, we can't provide a market for them, unless one of the export lines which is connected to them may have no market for their gas. I can see no solution of that problem, because we are not justified in connecting reserves we can't find a market for.

THE CHAIRMAN: Wouldn't there be a solution if you had a complete grid system in the province?

MR. YORATH: It would be a very expensive proposition.

THE CHAIRMAN: Might it not tend to develop gas reserves more quickly?

MR. YORATH: Well, the whole idea of Trunk Line, really, is the grid system -- the Alberta Trunk. It will be built wherever it is

economic to collect gas, but it may be questionable whether it be economic to go out and pick up some of these smaller fields.

THE CHAIRMAN: Aren't those smaller fields liable to get larger if the gas from the few wells there is picked up by reason of further exploration?

MR. YORATH: Is it possible they may expand it, yes.

THE CHAIRMAN: How is the site and route of a transmission line laid out -- wherever the best gas is?

MR. YORATH: Where it leads to the most gas most economically, and having regard to terrain.

THE CHAIRMAN: Thank you very much.

MR. COMMISSIONER CUSHING: It is not too clear in my mind, and I don't think it has come out in front of the Commission as to who actually owns the Alberta Gas Trunk Line: is it a child of the Government, or what is it?

THE CHAIRMAN: Mr. Willson, you are a director of that line?

MR. WILLSON: Yes, sir.

THE CHAIRMAN: So, Mr. Cushing will direct that question to you.

MR. WILLSON: The company has two classes of equity stock: it has 2,002 Class A shares, and an authorized capital of 8 million class B shares. The A shares are issued to producing companies,

transmission companies, the gas export companies, and utility companies, on the basis of the formula that takes into account the investment these companies have in facilities, and in the case of gas producing companies the gas reserves they control, and about 900 of the 2,000 shares have been issued to existing producers, transmission companies and utility companies. The producers group elect three directors, the export companies have one director, the utility companies have one director, and the Lieutenant Governor in Council appoints two directors to represent the citizens at large. So, it is that group of seven directors who control the company, and of the 8 million class B shares roughly 2½ million were sold to the public last March and about $13 million was raised to cover the cost of the company's '57 construction program. The balance of the cost of the system necessary to gather gas for Trans-Canada is expected to cost about another $40 million, which it is proposed to raise by the sale of first mortgage bonds. The company is not held by any particular group. It does not have any sponsors other than the Government of the Province of Alberta, and the voting shares, class A, are held by the groups I mentioned.

MR. COMMISSIONER CUSHING: Who conceived this idea? Is it a Government idea?

MR. WILLSON: I believe it is the

idea of Mr. Manning and the Conservation Board.

MR. COMMISSIONER CUSHING: But they now really have no control over it?

MR. WILLSON: No, sir.

MR. COMMISSIONER CUSHING: So you can't say it is a grid system operated by a government. It is more like a grid system operated by a formal corporation amongst the class A shareholders?

MR. WILLSON: That is correct.

MR. COMMISSIONER CUSHING: . . . who have a vested interest in the gas in the province?

MR. WILLSON: That is correct.

MR. COMMISSIONER CUSHING: Why I asked that question is, I understood you to say, Mr.Willson, that the utility companies do not favour the grid system of the collecting of gas?

MR. WILLSON: I didn't mean to give that impression. I think there are advantages to combining the gathering of gas for local use and export. Under certain circumstances, if you were to combine those functions, the unit cost of carrying gas in one pipe line is considerably less than the unit cost derived from separate pipe lines, and we are in favour of taking advantages of those economies wherever possible.

MR. COMMISSIONER CUSHING: I couldn't understand you making a statement like that if you were a director of the company.

MR. WILLSON: No.

MR. COMMISSIONER CUSHING: Presumably all of the rates for the Alberta Gas trunk line come under the Board of Public Utility Commissioners?

MR. WILLSON: Yes, sir.

MR. COMMISSIONER CUSHING: It is classed as a common carrier?

MR. WILLSON: Yes.

MR. COMMISSIONER CUSHING: So all of the new projections -- and I think we have had an enlightening here today on the proposed lines for Alberta and Southern and Westcoast and I, for one, was under the impression they were going to be built by those companies, but it has now come out they are going to be built by Alberta Gas trunk lines, so the rates for these lines would be set by the Board of Public Utility Commissioners?

MR. WILLSON: Yes. There is a little difference in the case of Westcoast, who propose to gather sour gas from certain fields, and in their submission to the Conservation Board they proposed that an Alberta subsidiary of Westcoast would be the company that would build and operate those pipe lines, but the Trunk Line Company at the Westcoast hearing opposed that suggestion and said they thought the Trunk Line Company should do it.

MR. COMMISSIONER CUSHING: So it is not

finalized definitely who will build this circle of Westcoast lines?

MR. WILLSON: No, sir.

MR. COMMISSIONER CUSHING: Not as yet. That is all.

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MR. COMMISSIONER HOWLAND: Yes, Mr. Chairman.

Mr. Willson, I would like to have a little more information about the price structure in the energy field here in Alberta. I am rather surprised to find that natural gas, which, I believe, is the best of all fuels, is cheaper than oil. Oil is looking for a market, too, apparently. How come that the best fuel in Alberta is the cheapest fuel? Is there something missing from the market?

MR. WILLSON: That just results from the utility regulation and cost of service approach to the pricing retail rates for natural gas, and in the case of our companies, I think we have made some fortunate arrangements which have resulted in gas being away underpriced compared with other fuels, and the company is only allowed to charge for gas service,its cost of service, including the 7 1/2 per cent. rate, retail. But, as a result, that approach leaves the product away underpriced, from a value point of view.

MR. COMMISSIONER HOWLAND: And do you get a lot of this gas from the oil companies under a long-term contract, or what? Why do they sell you the gas so cheaply?

MR. WILLSON: Well, in the case of our Edmonton company, we produce about half our gas

from our own fields that we own, and the other half we buy largely from oil companies in the Leduc field and Bonnie Glen field, and it is bought under -- we pay 7 1/2¢ a thousand cubic feet for it. It is not purchased under a firm delivery contract; it is an arrangement that we buy whatever gas they have available and, therefore, the price is somewhat less than if it were for a firm contract demand, and I think the fact that we were the only market outlet in that area is another reason why the price is as low as it is.

MR. COMMISSIONER HOWLAND: Do you foresee that, under the present circumstances of the rather difficult oil market, do you foresee that tending to put oil on the market at a more competitive price, fuel oil, because of your limited export markets themselves? Is this going to affect the market for gas?

MR. WILLSON: Well, I think it will. Mr. Trexel, in his summary, mentioned the surplus position that heavy fuel oil will be in shortly, with the railroads going over from steam to diesel and that there is some 300 million barrels of heavy fuel oil a year that will be surplus to market requirements, and the Stanford people tell us that they think the price of heavy fuel oil will come down substantially, just in order to market the product.

MR. COMMISSIONER HOWLAND: Is there not some indication that oil, at the moment, is in difficulty?

MR. WILLSON: Well, the demand for crude oil is down; but I believe the market for crude oil, for refining within the Province -- that is the source of the heavy fuel oil that is referred to in the Stanford report -- is probably not too different this year.

MR. COMMISSIONER HOWLAND: Well, I do not want to push you too far on this matter because I cannot get the right question yet; but is it true that only to a very limited extent the energy resources are being brought into use or allocated by the price of the market?

What I am getting at is, in a competitive economic system, there is this price factor, drawing into use coal and oil and gas just exactly according to the B.T.U. content, the efficiency in use. I gather gas is the most efficient fuel, according to your statement; and yet it is cheaper. That is all I am trying to get at. Has something limited this? You say it is the public regulation.

MR. WILLSON: Yes, and the fact that gas has not been able to seek, price-wise, its level in the competitive situation; but, rather, because of the limited return under utility regulation the price is far below what it would command in a

competitive market.

MR. COMMISSIONER HOWLAND: And this outlet is export from Alberta, is it? I do not mean export from the country necessarily; but is export from Alberta a big factor?

MR. WILLSON: Well, I think that export from Alberta is necessary, if we are going to have our gas resources developed.

MR. COMMISSIONER HOWLAND: Not only gas, but the allocation of the most efficient fuels to the best advantage, oil and coal and so on. If you have removed the discipline of the marketplace or the price structure, you are allocating your resources by some other mechanism, and you say it is by regulation?

MR. WILLSON: Yes.

MR. COMMISSIONER HOWLAND: Does the export of gas tie up with this problem of bringing back into the allocation of resources the price structure?

MR. WILLSON: Well, as gas distributing companies -- one of the things which concerns us about gas export is the additional market outlets that gas will, by itself, bring out and increase in the field price of gas; you will have more people bidding for gas and, because it is in more high demand, it will command a higher price.

The price of gas in the field is not regulated. It will seek a price through the law of

supply and demand, and that will undoubtedly be a higher price than is presently in effect, which will tend to bring coal into a more competitive position, price-wise, and, as mentioned in the report, the proven coal reserves in the Province are equivalent to 928 trillion feet of gas; so the coal resources of the Province are many, many times the gas resources, from a B.T.U. energy point of view, and I think, down the road, they will come into their own much more than they are today.

MR. COMMISSIONER HARDY: Mr. Chairman, just to follow up this discussion that is going on:

I take it, from your comments, that the control that has been exerted so far in the Province has been very successful in holding down the local price of gas, and that control has consisted of not the designation of fields to Calgary or Edmonton, but it goes more or less by default by stating that export permits are granted only from certain areas, and that means that the other areas cannot be exported from.

MR. WILLSON: Well, I don't think so, Dr. Hardy. The situation, as I see it, is this: for a number of years there was not sufficient gas indicated in Alberta to interest pipeline companies coming in here for it; but, in the last few years, the rate of discovery of gas has established that the ultimate proven reserves of the Province are

going to be very substantial and, as a result, we have, today, three companies, one already in operation, Trans-Canada, and two others seeking permits to export gas from the Province, and that has been brought about by the discovery of gas reserves, which has been somewhat incidental to the search for oil.

MR. COMMISSIONER HARDY: Have not the permits that have been granted so far for export been from designated fields, not all fields?

MR. WILLSON: That is correct.

MR. COMMISSIONER HARDY: But the Alberta Southern contract is, really, of a different type.

MR. WILLSON: No, it is from designated fields; and, in addition to that -- Alberta and Southern, as I understand it, has applied for permission to export gas from specific fields and, in addition to the contracts that they have negotiated with producers in those fields, they are also filing with the Conservation Board option agreements with certain producing companies whereby Alberta and Southern gets first call on gas that these companies might discover in certain areas.

MR. COMMISSIONER HARDY: But, in the case of your companies, if this contract you have with Alberta and Southern is approved, you are then permitted to export from fields that you now have under contract; whereas, now, at the present time, you

cannot. Is that correct? Anything you sell to Alberta and Southern, if now or in 1960 or whenever they go into operation, will come from the fields which you already have under contract?

MR. WILLSON: Well, one thing: we do not contemplate that any of our existing fields would ever be used to supply export markets. Your second thing, even if that were contemplated, Provincial approval would be required before that gas could be taken out of the Province; Conservation Board approval would be necessary.

MR. COMMISSIONER HARDY: In other words, this contract here, would there be a limitation that any gas you supplied under those terms would only come from fields which received the approval of the B ard? If the Board approved this contract, would that not give you the right to take any of your gas and sell it to Alberta and Southern?

MR. WILLSON: Well, the Board has a responsibility to assure the local supply, and I am just surmising at the moment, Dr. Hardy, but I think they would very definitely have quite a bit to say if we suggested, for example, that gas from the Leduc field was to go into an export pipeline.

MR. COMMISSIONER H RDY: You do not expect that there would be any change in the amount of control of the available gas that the regulations, if this contract were in force with

Alberta and Southern, that the local producers would still be protected and, as a company, you figure you would have long-term protection that you would not have without the contract?

MR. WILLSON: That is correct.

MR. COMMISSIONER HARDY: The second part of the control is as to price, and this contract seems to throw overboard the question of price control. In the statement which Mr. Helman read first thing this morning, that type of control is not possible, apparently, in the United States, constitutionally; but, in any event, it appears that we have it, up until the present time, without it being in force for many months. Is there any other reason, besides this discussion as to the necessity of meeting the problem of confiscation of capital, any other reason why you would say this present system, which does appear to be keeping the price down, is ---

MR. WILLSON: Well, the present system, from a consumer's point of view, or looking at it strictly from the point of view of the retail rates only, is much more beneficial for the consumer, in Alberta.

MR. COMMISSIONER HARDY: Well, as a consumer, maybe I might like that; but, from the point of view of the purposes of the Commission, I think there is a principle here.

What I am trying to get at is, is there

anything else wrong with this method of control, which appears to be somewhat unique on this continent, at least in price control? What would happen, eventually, if anything?

MR. WILLSON: Well, this question of price ---

MR. COMMISSIONER HARDY: There is confiscation of capital; is that the only basis, your only basis?

MR. WILLSON: I think our situation can be summarized, briefly, like this: assuming that there are 75 -- there will be, ultimately, something of the order of 75 trillion cubic feet of gas proven in the Province. There has to be export from the Province, because local markets are just not large enough; and that means that there will be competitive bidding for gas supplies within the Province.

Now, if we are to have a two-price system, one price for export and the other price for local users, then the producers supplying local consumers will either be discriminated against or will have to be compensated for, and some want to bring their total revenue up to a level as if they were supplying an export market and, in our study of the situation, we felt an unrealistic situation to contemplate, so, therefore, we felt that if we were going to be in a position of going out and contracting for the

necessary gas supplies for Alberta use, we had to be prepared to pay the same price in the field as the export companies.

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MR. COMMISSIONER HARDY: But supposing you were handed a proven area, for example. Would it make any difference to you if you had to pay field prices or whether you simply paid your own cost of development?

MR. WILLSON: Well, if the company were given by the Government -- are you assuming ---

MR. COMMISSIONER HARDY: Well, I do not understand this business of confiscation. In the section in here you talk about private owners. Do the private owners get this confiscation in the first place?

MR. WILLSON: They lease them in the first place.

MR. COMMISSIONER HARDY: And if you find gas in an area of the ---

MR. WILLSON: Yes, which they sell.

MR. COMMISSIONER HARDY: Yes, which the Province sells.

MR. WILLSON: Yes, to the highest bidder.

MR. COMMISSIONER HARDY: Just before they sell it, it is public property?

MR. WILLSON: Yes.

MR. COMMISSIONER HARDY: And they could make a deal with you, if they choose to do it, and that would not affect you. You could still be maintaining a two-price system without arguing this matter of confiscation?

MR. WILLSON: Yes. If they were, in fact, to hand over their leases in a proven field to us then we could develop those leases, and presumably half the cost would be ours and the other half would be the producer's who found the gas. We would have to pay that producer, then, an appropriate price for his 50 per cent., and the 50 per cent. that the company developed would only cost the consumer the actual proper regulated cost of the company, and that would undoubtedly result in a lower cost total than having it developed by private companies in total.

MR. COMMISSIONER HARDY: And Mr. Frawley this afternoon suggested, Mr. Willson, that the Alberta Southern contract might possibly be reviewed by the Board of Public Utility Commissioners. Under what circumstances would this contract ever go to them for approval in the sense that they could make adjustments to it, or turn it down?

MR. STEER: I would want to think about that. I was not sure, when Mr. Frawley mentioned it, that it was so.

MR. COMMISSIONER HARDY: The reason I was asking, Mr. Steer, is that we were told that the Board of Public Utility Commissioners had no control over contracts such as this. It was brought to them simply as an accomplished fact, and they used the information in the contract in any rate

discussions.

MR. STEER: That is my conception of it.

MR. COMMISSIONER HARDY: That is all, Mr. Chairman.

THE CHAIRMAN: Mr. Yurath, Mr. Willson and Mr. Trexel, thank you very much indeed, and I will include you, Mr. Steer, in that also. This has been a very informative brief to the Commission, and obviously a great deal of time and study and preparation was put into it. Thank you very much, gentlemen.

Before we adjourn I would like to say that tomorrow morning at 9.45 the Canadian Petroleum Association will present its brief to the Commission, and we will adjourn now until that hour tomorrow morning.

---Whereupon the hearing adjourned at 4.50 P.M. until 9.45 A.M. Tuesday, February 11, 1958.

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Mr. Borden

ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

VOLUME No.: 6

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ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary, commencing Monday, February 3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.

Mr. Miles H. Patterson.

Mr. J.F. Parkinson	--	Secretary to the Commission.
Major N. Lafrance	--	Assistant Secretary to the Commission.

APPEARANCES:

Representing Canadian Petroleum Association:

Mr. S. Douglas Turner)		
Mr. William P. Taylor)	-	Counsel
Mr. T.W.G. Thomson	-	Member, Board of Governors.
Mr. John W. Proctor	-	General Manager

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Tuesday,
February 11, 1958

---Upon resuming at 9.45 A.M.

---Mr. Commissioner Hardy was not present.

THE CHAIRMAN: The Commission will now resume its hearings. We have this morning the brief of the Canadian Petroleum Association, Mr. Patterson?

MR. PATTERSON: That is correct, sir. Before we get underway there are one or two outstanding matters from yesterday. In connection with a question that was asked with respect to the stock ownership of Pacific Coast Transmission Company, Mr. Steer has been good enough to supply me with a breakdown of the stock ownership in that company which, if it pleases the Commission, I will read.

Stock Ownership: Pacific Gas and Electric, 50 per cent.; Bechtel Corporation, 9 per cent.; Blyth & Company, 7 per cent.; Alberta Utilities, 7 per cent.; Montana Power, 2 per cent. Eventually the general public will own 25 per cent.

There is another small matter, sir ---

THE CHAIRMAN: Well, that is as he said yesterday, Mr. Patterson.

MR. PATTERSON: Yes, that is as he said yesterday. I think the problem was that some persons

were not clear on it. I believe Mr. Helman had not quite clearly gotten that. Mr. Steer also drew to my attention that in answer to a question about the time when Mr. Yorath received a copy of a certain agreement he had made a statement that was in error. I felt that the time was not of great importance to the Commission, but for the record, perhaps, Mr. Steer would just correct the statement made by Mr. Yorath.

MR. STEER: Mr. Chairman, at page 687 of yesterday's record there is a reference made in line 5 to an agreement between Westcoast Gas Transmission and Alberta and Southern; that should read "Westcoast Transmission and Westcoast-Alberta." Those two companies made an agreement under which it was said that the local needs of consumers in Alberta were protected, and that was the agreement that was being referred to by Mr. Helman when he asked Mr. Yorath when first he knew or had a copy of that agreement. Mr. Yorath's recollection was that it was a few days before the hearing of the Conservation Board in December when Westcoast's application for a permit to export gas was being considered. On searching his records he finds that he was mistaken, and that he had a copy of that agreement towards the end of October, the hearing having taken place in December.

THE CHAIRMAN: Thank you very much, Mr. Steer.

Submission of

CANADIAN PETROLEUM ASSOCIATION

APPEARANCES:

Mr. S. Douglas Turner	-	Counsel
Mr. William Taylor	-	Counsel
Mr. John W. Proctor	-	General Manager, Canadian Petroleum Association.
Mr. T.W.G. Thomson	-	Member, Board of Governors, Canadian Petroleum Association.

MR. PATTERSON: Now, sir, we may proceed with the brief submitted by the Canadian Petroleum Association. I would ask that a copy of that brief, which has been handed to Mr. Belanger, be marked as Exhibit C-11-1. I understand that reading the brief will be Mr. Proctor, who is general manager of the Association, and Mr. Thomson who, I believe, is chairman of a special committee that was formed for the purpose of submitting this brief, and that after the reading of the brief the gentlemen whose names are before you in the list of technical witnesses will be available to assist in the answering of questions. I suggest that we follow the procedure that we have used in the past of directing our questions to Mr. Proctor and Mr. Thomson, and that they then request the assistance of these other gentlemen.

---EXHIBIT NO. C-11-1: Submission of Canadian Petroleum Association

MR. FRAWLEY: Mr. Patterson, what list are you referring to? Have you some list?

MR. PATTERSON: Yes, Mr. Turner has lists for those who have not yet received one.

MR. PROCTOR: I assume we can take the letter of transmittal, which is the first item, as read, Mr. Chairman?

February 7th, 1958. The Royal Commission on Canada's Energy Resources. Gentlemen: By order of the Board of Governors of the Canadian Petroleum Association, I submit herewith the Association's studies on subjects of concern to your Commission as listed in the table of contents.

The purpose of this submission is to acquaint the members of the Commission with the problems facing the exploration and production phases of the Oil and Gas Industry in Canada.

In order to assist the Commission, additional statistical information regarding marketing and refining facilities have been included in this submission.

Respectfully yours, "John W. Proctor, General Manager, For and on behalf of The Canadian Petroleum Association."

MR. TURNER: Mr. Chairman, before Mr. Proctor commences to read the brief, I would like to say that I am representing the Canadian Petroleum Association, and I have with me Mr. W.P. Taylor.

I am a member of the Association's permanent staff, and Mr. Taylor is a head of one of our member companies and is also chairman of our Legal Committee within the Association.

Before we commence reading the brief, sir, I would like to make two remarks. One is that Mr. R.C. Brown, the chairman of our Board of Governors of the Canadian Petroleum Association, regrets that he is unable to be with us today. He was called away to the East on business and had planned to be back for our scheduled appearance tomorrow, but since we are making our appearance today he has found it impossible to be back and he has asked that we express his sincere regrets to you and the members of your Commission.

THE CHAIRMAN: Thank you very much, Mr. Turner. It is our fault.

MR. TURNER: Secondly, the Canadian Petroleum Association has been most pleased to render any assistance to the Commission and the staff which it may have been able to render, and we wish to assure you that we are prepared to help out in any further way which the Commission thinks desirable and useful in the course of its extensive considerations of the oil and gas industry. I think now, sir, we can proceed with the presentation of the brief.

THE CHAIRMAN: Thank you very much, Mr. Turner.

MR. PROCTOR: Mr. Chairman, I assume that we have taken the letter of transmittal and the table of contents, the first two pages, as read?

THE CHAIRMAN: Yes.

MR. PROCTOR: Introduction: The Canadian Petroleum Association is an association of some 274 Exploration and Producing Companies which together produce 97% of the Oil and Gas produced in Canada. The Association also has 63 Associated member companies whose business is ancillary to the search for and production of oil and gas.

The principal purposes of the Association are:

(i) To establish better understanding between the petroleum and natural gas industry and the public;

(ii) To encourage co-operation between the petroleum and natural gas industry and Federal, Provincial and local governments, and other authoritative bodies;

(iii) To provide a forum for the discussion of matters affecting the welfare of its members.

(iv) To foster better understanding between this Association and other organizations with similar objects and purposes.

The Association is governed by a Board of Governors elected annually by secret ballots. Each company regardless of its financial structure or the

the extent of its activities, has only one vote.

The Association is further sub-divided into:

(1) Alberta Division with its own Board of Directors.

(2) Saskatchewan Division with its own Board of Directors.

(3) A Standing Committee for British Columbia.

(4) A Standing Committee for Manitoba.

(5) A Standing Committee for The Northwest Territories.

(6) 60 Standing Committees dealing with Industry Problems.

The Board of Governors is responsible for co-ordinating policy among the divisions and committees and for overall Canadian policy. The constitution of the Association allows for the establishment of further divisions as the industry expands in other parts of Canada.

As a service to its members the Association maintains a Statistical Department, and periodically issues industry statistics of interest to its members and to governmental and regulatory bodies. Among these statistics are estimates of reserves of oil and gas compiled from data furnished by member companies.

Owing to the highly competitive nature of the oil and gas business the members regard their estimates of reserves as confidential records and

give them to the Canadian Petroleum Association only on the understanding that they will be held in the strictest confidence. Without this understanding no information would be given, and the C.P.A. would be unable to compile accurate records.

Reserve estimates are compiled by areas in such a manner that no member of the Reserves Committee knows that the total reserves of any individual company are, but only knows its reserves in the particular area to which he has been assigned.

The following information and data deals only with the industry as a whole. For the purposes of this brief in matters and problems of the industry of a controversial nature where the Association cannot represent the policy of all its members, no recommendations are made, as the Association cannot show partiality towards any one group.

Therefore, in preparation of this brief, the Association has been able to .al only with the subjects on which there is no apparent conflict of opinion or interests among its members.

MR. THOMSON: Present Provincial Policy Towards Exploration, Development, Drilling, Conservation and Production: The policies of all four western governments are sufficiently similar that they can be commented upon collectively, the comments upon one, generally speaking, being applicable to all four.

Broadly speaking, Provincial government regards the petroleum industry as a partner in the industrial progress of the Province. Its policy is to encourage development of its mineral resources by private enterprise and obtain a just landowner's revenue for the people of the Province at no financial risk. Rights to explore and produce are sold and leased on terms sufficiently stringent to yield a handsome return to the Provincial treasury, (In Alberta some $700 million in the past eleven years) and sufficiently lenient to have attracted an influx of risk capital in excess of $3 billion. Stability of government and a declared intention not to enter the oil business in competition with industry, have also been considerable factors in attracting risk capital.

Regulations in force are aimed largely at maintaining equity among all producers large and small, ensuring efficient operation and the prevention of waste or over-production and encouraging active exploration. While strictly enforced they are generally not so onerous that industry cannot live without them agreeably.

However, government authorities maintain a rigid control upon its mineral resources, by means of permits, licences, etc., and virtually no operation can be undertaken without government consent. This is particularly true in the matters of export

of natural gas.

For example: For some years, the Province of Alberta would not allow any natural gas to be exported from the Province. When it was proved conclusively that the gas resources were far in excess of the Province's needs in the foreseeable future, it permitted export of the surplus. Estimates of reserves and Provincial requirements are revised each year, and only the surplus is considered available for export permit.

A co-operative atmosphere exists between industry and Provincial Government at all levels. Round table conferences to discuss problems which arise are of fairly common occurrence and are mutually beneficial.

Investment and Economics: Statistical data on expenditures and income of oil and gas producers in Western Canada have been compiled and analyzed for the period 1951-56. This period was chosen because published records of industry expenditures are not available for prior years. However, we feel that this period taken as a whole, gives a realistic insight into the unusual economics of oil and gas exploration and production

Investment in Crude Oil and Natural Gas Reserves 1951-56: Acquisition costs (land acquisition and rentals, geological and geophysical, exploratory drilling) are the largest expenditures of the industry and a major portion of them resulted in neither oil nor gas production. In many cases, although resulting in production, the potential income developed is less than the amount invested in the prospect.

Almost all expenditures under "acquisition costs" were directed primarily towards exploration for oil. Results indicate a favourable discovery rate for natural gas, but in very few instances was exploration directed towards its discovery. The extremely long delay between investment and income, resulting in a lengthy payout, minimized the incentive to explore for natural gas. The rate of return on investment fluctuates with the length of the payout period. Restricted crude oil production -- as it

[illegible]

prevails to a large degree at the present time -- will lengthen the payout and thus reduce the rate of return on investment. If this situation should prevail for a prolonged period, it will have the same effect on exploration for oil as it has shown on exploration for gas.

Development costs are mostly the charges for the completion of wells to make possible the withdrawal of the reserves discovered. It must be realized, when considering these expenditures, that natural gas reserves have only been developed to a very limited extent. In future years, vast sums of capital will be required for development wells, field equipment, and processing plants before revenue can be derived. Investment statistics for 1957 are not available but they will, to some degree, reflect higher development expenditures as producers commenced the development of gas discoveries to meet the requirements of the Trans-Canada and Westcoast Transmission pipe lines.

Wildcat drilling records for British Columbia and the Prairie Provinces show that, from 1951 to 1956, the 3,722 wildcat tests drilled, found 67 commercial oil and 134 commercial gas fields, or 1 oil to 2 gas (commercial being defined as the discovery of reserves of more than one million barrels of oil or 10 billion cubic feet of gas). In the same period, development statistics

show only one gas well completed for every 19 oil wells.

Income from Production 1951 - 1956: Oil and gas produced during this period brought in $1,453 million. From this must be deducted a royalty share for the holder of the mineral rights and the operating costs associated with the withdrawal of the reserves.

Industry Cash Position 1951 - 56: During the period 1951 - 56, the industry invested $1.89 in exploration and development of reserves for every dollar of operating income, thus incurring a cash deficit of $936 million. The deficit is still increasing after more than 10 years of successful operations.

The extensive investment of $1,991 million has been made with the belief that the reserves found -- both oil and gas -- could be produced and sold with a reasonable dispatch. The strength of the industry and future expansion depend directly on the prospects for the recovery of not only the present cash deficit, but also the recovery of new investment, in a reasonable period of time. The investment climate must be kept sufficiently appealing to foster re-investment and to attract new risk capital.

Mr. Chairman, then on page 4 there is a statement. Would you like me to read that or shall we take that as read?

THE CHAIRMAN: I think we can take that as read.

MR. THOMSON: It breaks down the total amount of investment and the total amount received.

ESTIMATED INVESTMENT AND INCOME 1951 - 1956

INVESTMENT:		
Acquisition Cost		
Land Acquisition & Rentals	$483,100,000	
Geological and Geophysical	$398,800,000	
Exploratory Drilling	$421,500,000	
	$1,303,400,000	
Development Cost	$ 687,300,000	
TOTAL INVESTMENT		$1,990,700,000
INCOME		
Value of Production		
Crude Oil	$1,403,600,000	
Natural Gas	49,000,000	
	$1,452,600,000	
Less Royalty Payments (12.5%)	181,600,000	
Less Production Expenditures	$ 216,100,000	
Income from Production		$1,054,900,000
NET CASH DEFICIT		$ 935,800,000

Long Term Investment Analysis: Through the future sale of the oil and gas reserves discovered in the period 1951 - 56, producers look forward to an

eventual profit. To illustrate this, a summary of costs on a "per barrel basis" has been prepared.

For simplification a constant production life of 20 years was assumed. Normally large fields produce over a longer period, and delays between exploration, discovery, development and production must be included when considering interest charges.

At present, there are over 700 gas wells in Alberta which have never been produced, representing an investment of over $60 million in well costs alone. Some of these wells were drilled as early as in the 1930's. The risk capital ventured in their drilling has not as yet produced any return and the cost of carrying these unproductive investments appreciates rapidly throughout the years.

Reserves to the petroleum and natural gas producer are comparable to the inventories of raw material which other industries require. However, only in the natural resources industries

(1) are such vast volumes evident, and

(2) is interest on investment, therefore, such a major item.

The oil and gas industry by its very nature requires that these inventories be paid for in advance. Thus, in an investment analysis, the interest that could otherwise be earned on the money invested in finding and developing these reserves, must be considered. It should be noted that the analysis

(1) does not consider taxes, and

(2) assumes immediate sale of all gas discovered during the period 1951 - 56.

When the production of either oil or gas is extensively delayed and/or considerably below the market that the reserves are capable of serving, the economic future of the industry is substantially depressed. Under current conditions of decreased revenue and high cost of carrying investment, prospects for improvement in the marketing picture are a prerequisite to a continued high level of activity in Western Canada oil and gas exploration.

On the following page, sir, the investment analysis breaks down the cost and the revenue into barrel basis which indicates, using the figures of the production reserves during the period under review, a total expenditure of $2.08 a barrel gross income. Oil and gas produced $2.41 a barrel.

Can I take that statement, also, as read?

THE CHAIRMAN: Yes, take it as read, Mr. Thomson.

INVESTMENT ANALYSIS

RESERVES:	BBLS.	TOTAL $	$/BBL
Crude Oil	2,194,400,000	---	---
Natural Gas (Equiv.bbls) (1)	390,000,000	---	---
	2,584,400,000		
INVESTMENT			
Acquisition cost	----	1,303,400,000	0.50
Development Cost (2)	----	687,300,000	0.31
Carrying Charge on (3) Investment (at 6%)	----	1,480,500,000	0.61
ROYALTY PAYMENTS (at 12.5%)	----	181,600,000	0.30
OPERATION OF WELLS (4)	603,600,000	216,100,000	0.36
TOTAL EXPENDITURES	----	----	2.08
GROSS INCOME FROM OIL & GAS PRODUCED	----	----	2.41

(1) For the purposes of illustration, natural gas was converted to crude oil on the basis 30 MCF = 1 BBL

(2) Development costs have been calculated against crude oil reserves only.

(3) The interest which would have been earned at 6%, on the investment in exploration and development, assuming equal annual repayments over twenty years.

(4) As experienced during the period 1951-56. In future years, as decline sets in, per well production will decrease resulting in higher per barrel cost. Also generally operation of wells will be more costly due to maintenance factors. In the U.S. the average cost per barrel for fields in all stages of depletion was reported to be 65 cents in 1953 (Petroleum Engineer, July, 1955).

Investment Analysis: In the following analysis, the presentation has been simplified by assuming that reserves are withdrawn at a constant rate over 20 years. This is not the case, since the average field produces throughout its early life at a constant rate and then declines over the remaining years, often extending beyond 20 years.

This analysis was designed to illustrate the effect of delayed income on the profitability of investment in exploration and development. The rate of return is dependent upon the initial rate of withdrawal and the decline assumed.

Mr. Chairman, this is a similar statement and if I may take that as read, also?

THE CHAIRMAN: Certainly.

Production of Reserves Found 1951 - 1956

		Barrels	Dollars	$/Barrel
Reserves				
Crude Oil	(1)	2,194,400,000		
Natural Gas (equivalent bbls)		390,000,000		
		2,584,400,000		
Income from Production				
Gross Revenue at 2.41			6,228,400,000	2.41
Royalty Payments at 12½%			-778,550,000	-0.30
Production Cost (2)			-930,380,000	-0.36
			4,519,470,000	1.75
Investment				
Acquisition			1,303,400,000	0.50
Development (3)			687,300,000	0.31
			1,990,700,000	0.81
Return on Investment before taxes				9%

(1) For purpose of this illustration, natural gas was converted to crude oil on th basis of 30 MCF = 1 bbls.

(2) As experienced during the period 1951-56. In future years, as decline sets in, per well production will decrease resulting in higher per barrel cost. Also generally operation of wells will be more costly due to the maintenance factors. In the U. S. the average cost per barrel for fields in all stages of depletion was reported to be 65 cents in 1953 (Petroleum

Engineer, July, 1955).

(3) Development costs per barrel have been calculated against crude oil reserves only.

MR. THOMSON: Then there is a statement on page 9 and that is a breakdown of these costs by provinces.

THE CHAIRMAN: I think we can also take both these breakdowns as read, Mr. Thomson, subject to you, at any time saying you wish to explain anything in connection with them.

MR. THOMSON: Yes.

ESTIMATED EXPENDITURES
1951 - 1956 (1)
(Thousand dollars)

	Alberta	B. C.	Sask.	Man.	Total
Acquisition Costs					
Land Acquisition & Rentals	392,500	3,800	64,800	22,000	483,100
Geological & Geophysical	323,300	24,000	45,100	6,400	398,800
Exploration Drilling	314,000	26,900	67,400	13,200	421,500
	1,029,800	54,700	177,300	41,600	1,303,400
Development Costs	540,400	2,900	112,900	31,100	687,300
Operation of Wells	195,700	100	15,700	4,600	216,100
TOTAL	1,765,900	57,700	305,900	77,300	2,206,800

(1) Estimated using as sources, expenditures published by the Provincial Governments of Alberta, Saskatchewan and British Columbia. Manitoba has been estimated on the basis of wells drilled, geophysical activity and a land survey.

Production costs for other provinces are estimated to be the same as Alberta.

The Northwest Territories were omitted.

MR. PROCTOR: Oil and Gas Reserves in Canada: The proved oil and tax reserves as defined according to the modified rules of the American Petroleum Institute and the American Gas Association, and the probable oil and gas reserves, have been estimated for Canada. The possible oil and gas reserves have been estimated quantitatively only for the Western Canada interior basin, although other basins are briefly described herein.

If you would note here, sir, we use the American API, American Petroleum Institute formulae. This was requested in order to have continental uniformity. May I take the tables of reserves as read?

THE CHAIRMAN: Yes.

Estimated Crude Oil and Natural Gas Liquid Reserves as of December 31, 1957

	Proved	Additional Probable
	(thousands of barrels)	
Northwest Territories	52,858	58,500
British Columbia	25,602	44,153
Alberta	2,721,587	816,771
Saskatchewan	420,954	172,074
Manitoba	34,258	5,065
Total Western Canada	3,255,259	1,096,563
Ontario	3,763	-
New Brunswick	92	
Total Eastern Canada	3,855	-
TOTAL CANADA	3,259,114	1,096,563

Estimated Producible Natural Gas Reserves as of December 31, 1957

	Proved	Probable
	MMCF	
Northwest Territories	29,705	30,274
British Columbia	1,803,075	662,216
Alberta	17,702,885	8,927,289
Saskatchewan	1,011,118	48,524
Manitoba	2,993	467
Total Western Canada	20,549,776	9,668,770
Ontario	190,287	-
Quebec	983	-
New Brunswick	1,085	-
Total Eastern Canada	192,355	-
TOTAL CANADA	20,742,131	9,668,770

MR. THOMSON: You will note, Mr. Chairman, the estimated crude oil total is 3,259,114 and the additional probable 1,096,563.

Then the estimated producible natural gas reserves as of December 31, 1957, is tabled and is a breakdown of areas.

You will note, sir, that in both cases we have included the Northwest Territories, four Western Provinces, Ontario and New Brunswick and, in the case of gas, the Province of Quebec. Our proved total is 20 trillion 742 billion 131 million, and the probable 9 trillion, 668 billion, 770 million.

THE CHAIRMAN: Are those figures net?

MR. TURNER: Do you mean, sir, are they marketable?

THE CHAIRMAN: Are they figures of proven reserves not yet taken out of the ground?

MR. TURNER: That is right.

MR. PROCTOR: Yes, they are remaining reserves.

THE CHAIRMAN: I have not had an opportunity to read further on to the end but do you, in any way, break these reserves down on the cost between the solution gas and associated gas and gas cap gas?

MR. PROCTOR: No, we have not done that, sir. If you would like that, we would be glad to do it for you.

THE CHAIRMAN: Would you be able to do it as we go through it or a little later?

MR. PROCTOR: Could we discuss that a

little later?

THE CHAIRMAN: Certainly, yes.

MR. PROCTOR: Proved and Probable Oil, Natural Gas and Natural Gas Liquid Reserves. Proved Reserves: In calculating proved reserves of oil, natural gas and natural gas liquids, the Canadian Petroleum Association Reserves Committee follows closely the principles established by the American Petroleum Institute's Committee on Petroleum Reserves, and the Committee on Natural Gas Reserves of the American Gas Association. Copies of the Rules for calculating such reserves are attached as Appendix 1.

It will be noted from these Rules that proved reserves are both drilled and undrilled. The proved undrilled reserves in any pool include reserves under undrilled spacing units which are so related to the drilled units that there is every reasonable expectation that they will produce when drilled. As a general rule in partially developed fields, only lateral and diagonal offsets to drilled wells are included. However, where the geological information is such that there is every reasonable expectation that undrilled spacing units further removed will produce when drilled, such spacing units are included.

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In the case of new discoveries, both of new fields and of new pools in old fields, in which there is only one well drilled at the time of making the estimate, it is the practice to use only one spacing unit for reserve calculations except where sufficient information is available to warrant taking in a larger area.

In a pool in which wells have been drilled, cased and found uncommercial after production tests, no reserves are estimated.

Reserves which become available as a result of fluid injection are regarded as proved only after a thorough test by a pilot project, or after operation of an installed fluid injection procedure has actually demonstrated certainty of increased recovery.

Estimates of proved recoverable natural gas reserves are those calculated to be producible down to an abandonment pressure considered practicable.

Reserves of natural gas liquids in respect to an oilfield are included only when there is a plant in operation for the recovery of the liquids. In the case of a wet gasfield, or a substantial gas cap overlying an oil column, reserves of natural gas liquids are included in the estimates whether or not there is a plant in operation.

Experience has demonstrated that proved

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reserves calculated by these rules are less, overall, than ultimate recovery.

Probable Reserves: Probably reserves of oil, natural gas and natural gas liquids were estimated for submission to this Commission. The additional reserves included in these estimates result from the following:

(1) Larger areal extent of proved fields, or the area assigned to discovery wells with relatively thick pay sections, which reasonably can be expected to produce on the basis of geological or geophysical information available.

(2) Additional reserves which may become available as a result of fluid injection. Included in this category are reserves from fields where pilot plants have actually indicated the probability of additional recovery as a result of fluid injection, or where laboratory studies have indicated probable increases. In certain instances, increased recovery was only estimated for the area where plans have been formulated for fluid injection.

(3) Increased recovery from presently proved fields. The increased recovery is based on reservoir studies which indicate that more oil probably will be recovered, but

such reserves cannot be considered in a proved category until substantiated by additional reservoir performance.

Then we have a table of the estimate of proved and probable reserves of liquid hydrocarbons in thousands of barrels. Now, that is supporting evidence for our No. 1 Table and you will note it is broken down into areas, as indicated previously.

The same has been done in the case of the next table for natural gas in MMCF.

ESTIMATE OF PROVED AND PROBABLE RESERVES OF LIQUID HYDROCARBONS IN CANADA
(thousands of barrels)

	Crude Oil	
	Remaining Proved Reserves as of Dec.31/57	Additional Probable Reserves as of Dec. 31/57
Northwest Territories	52,858	58,500
British Columbia	2,093	35,525
Alberta		
Area 3	133,892	41,000
Area 4	544,430	72,415
Area 5	430,745	247,760
Area 6	850,734	19,288
Area 7	36,692	33,565
Area 8	252,229	56,847
Area 9	81,074	13,580
Area 10	2,705	5,000
Area 11	18,432	82,000
Total Alberta	2,350,933	571,455

(cont'd)

	Crude Oil	
	Remaining Proved Reserves as of Dec. 31/57	Additional Probable Reserves as of Dec.31/57
Saskatchewan		
Area 1	11,393	2,640
Area 2	22,052	600
Area 3	56,560	13,351
Area 4	57,532	6,679
Area 5	142,288	111,000
Area 6	130,632	17,400
Total Saskatchewan	420,457	151,670
Manitoba	34,258	5,065
Eastern Canada		
Ontario	3,763	-
Quebec	-	-
New Brunswick	92	-
Total Eastern Canada	3,855	-
Total Canadian	2,864,454	822,215

	Natural Gas Liquids	
	Remaining Proved Reserves as of Dec. 31/57	Additional Probable Reserves as of Dec. 31/57
Northwest Territories	-	-
British Columbia	23,509	8,628
Alberta		
Area 3	-	-
Area 4	10,006	-
Area 5	25,000	97,500
Area 6	180,880	8,546
Area 7	-	-
Area 8	28,563	-
Area 9	19,171	55,065
Area 10	-	-
Area 11	107,034	84,205
	370,654	245,316

(cont'd)

	Natural Gas Liquids	
	Remaining Proved Reserves as of Dec. 31/57	Additional Probable Reserves as of Dec.31/57
Saskatchewan		
Area 1	-	-
Area 2	497	-
Area 3	-	-
Area 4	-	-
Area 5	-	20,404
Area 6	-	-
	497	20,404
Manitoba	-	-
Eastern Canada		
Ontario	-	-
Quebec	-	-
New Brunswick	-	-
Total Eastern Canada	-	-
Total Canadian	394,660	274,348

ESTIMATE OF PROVED AND PROBABLE RESERVES OF NATURAL GAS IN CANADA.
(MMCF)

	Remaining Proved Reserves as of Dec. 31/57	Additional Probable Reserves as of Dec. 31/57
Northwest Territories	29,705	30,274
British Columbia	1,803,075	662,216
Alberta		
Area 3	763,286	596,700
Area 4	844,778	789,553
Area 5	1,495,854	475,838
Area 6	3,508,261	729,473
Area 7	1,343,113	340,665
Area 8	1,595,288	497,550
Area 9	1,735,234	2,457,736
Area 10	2,326,801	900,000
Area 11	4,090,270	2,139,774
Total Alberta	17,702,885	8,927,289
Saskatchewan		
Area 1	20,692	1,785
Area 2	382,444	17,025
Area 3	206,171	94,464
Area 4	18,313	-
Area 5	357,095	-68,050
Area 6	26,403	3,300
Total Saskatchewan	1,011,118	48,524
Manitoba	2,993	467
Eastern Canada		
Ontario	190,287	-
Quebec	983	-
New Brunswick	1,085	-
Total Eastern Canada	192,355	9,668,770
Total Canadian	20,742,131	

We then have a map showing the areas in Alberta and, in Saskatchewan, another map showing the breakdown of our areas.

I might point out, Mr. Chairman, that each member of the committee is assigned a particular area in which there are at least three or more fields and he simply reports the bulk to the remainder of the committee.

May I go on with the brief?

THE CHAIRMAN: Yes, sir, thank you.

MR. PROCTOR:

PROVED AND PROBABLE SULPHUR RESERVES

The proved and probable sulphur reserves have been estimated where it is anticipated that sulphur will be recovered from the hydrogen sulphide contained in the estimated proved and probable natural gas reserves.

ESTIMATE OF PROVED AND PROBABLE RESERVES OF SULPHUR IN CANADA
(thousands of long tons)

	Remaining Proved Reserves as of Dec. 31/57	Additional Probable Reserves as of Dec. 31/57
Northwest Territories	-	-
British Columbia	1,648	560
Alberta	28,092	39,658
Saskatchewan	87	54
Manitoba	-	-
Eastern Canada	-	-
TOTAL	29,827	40,272

Following that, Mr. Chairman, for the convenience of the Commission we have included two schematic maps of the location, first, of the gasfields of B.C. and Alberta, which takes in the British Columbia Peace River block, where, as you know, there has been some development; and the second map is of Saskatchewan and Manitoba.

MR. THOMSON: Possible and Gas Reserves: The Arctic Islands: There are several basins in Canada that have possible oil and gas reserves. Other than the great sedimentary basin of Western Canada, the larger of these in which the potential production may be of considerable magnitude, is in the Arctic islands. Here a favourable sedimentary sequence and the presence of several salt domes similar in structure to those of the Gulf Coast of the United States are known. No wells have been drilled in this area. It is reported that oil is being produced in the U.S.S.R. opposite the Canadian Arctic islands from strata that are the extension of the same basin.

Hudson Bay and James Bay Area: Another sedimentary basin occurs on the south and west sides of Hudson Bay and James Bay. This area is 800 miles long and from 75 to 225 miles wide, with an area of about 125,000 square miles. ("Possible Future Petroleum Provinces of North America," Bulletin American Association of Petroleum Geologists, Volume 35, No. 2, 1951, P. 458). A small part of this is in Manitoba

with the remainder in Ontario. The sediments are largely marine Palaeozoic strata with evaporites (gypsum, anhydrite, etc.) overlain in part by Cretaceous beds containing lignite. In most of the area the sediments are thin, but there are areas where at least 2,000 feet are present, a thickness sufficient to give oil and gas prospects. Only a limited amount of drilling has been done.

The Southwest Peninsula of Ontario: The Ontario basin bounded by Lake Huron, Lake Erie and Lake Ontario, including the Manitoulin Islands, is bounded on the north and east by the Precambrian Shield which crosses the St. Lawrence River in the vicinity of Brockville. It comprises about 25,800 square miles. Only that part south and west of the Niagara escarpment stretching from Bruce Peninsula to Queenston on the Niagara River, has yielded oil and gas in commercial volumes. Drilling commenced in this area in 1859, and several relatively shallow oilfields with prolific production resulted. Some of these still continue to yield oil. In recent years the area has been more intensively searched for gas rather than oil, and much greater success has been achieved than was formerly thought possible in an area where thousands of wells had been drilled. Drilling has been done in Lake Erie off the shore of Kent County with some considerable success. Less success has attended efforts to find production under

Lake St.Clair. There is no doubt exploration will continue for a long time to come with moderate success. For many years the Dawn field in Lambton County has been used as a storage basin for gas imported from the United States in off-peak summer periods. There are many other fields that could be developed for storage and in this the area has a tremendous significance in relation to transportation of gas from Western Canada for use in Central Canada.

The St. Lawrence Lowland: The St. Lawrence lowland, stretching into Eastern Ontario, but mainly in the Province of Quebec, contains a large area of older Palaeozoic strata. Actually, the area is a large basin with axis parallel to the St. Lawrence River. Its length is more than 200 miles and its width is about 60 miles near Montreal. On the southeast it terminates against the belt of disturbed rocks which are the northward extension of the Appalachians. Some recent success has been achieved in finding gas near Three Rivers, and at present several companies are engaged in active exploration. The prospects are considered reasonably good.

Gaspe Peninsula: Also in Quebec the Gaspe Peninsula has been known for more than a century to contain favourable structures in Palaeozoic rocks with numerous oil seepages. An area of Devonian rocks is known over a distance of 150 miles, with a width

of about 35 miles, and there are Palaezoic rocks covering Anticosti Island in the Gulf of St. Lawrence. In the period between 1860 and 1903 fifty-seven wells were drilled in Gaspe, and oil in small quantities was found. One deeper well was drilled in 1913 and there have been several since 1939. The lack of success, briefly stated, seems to have been due to absence of reservoir rocks that could contain commercial accumulations of gas and oil, but there is no doubt other features are favourable and the prospects are by no means exhausted. Reef limestone in the Silurian would seem to offer the best opportunity for prospecting, but this will require deeper wells than have yet been completed.

The Gaspe area is interesting from a geological historical point of view. It was from studies in this area that Sir William Logan, founder of the Geological Survey of Canada, and his colleague, Sterry Hunt, propounded the anticlinal theory in 1844. The theory was quickly put to practical application in Kentucky and West Virginia with marked success and has had a profound effect on all subsequent exploration in every part of the world.

Maritime Provinces: In the Maritime provinces of Canada there are sedimentary basins in New Brunswick, crossing Northumberland Strait and including Prince Edward Island, and extending into a part of Nova Scotia along the northwest flank of

that province. The only production so far found comes from the Stony Creek field discovered in 1909, nine miles from Moncton in New Brunswick. In this area are also the Albert Oil shale deposits. These were evaluated by drilling during the last war by a total of 79 holes, aggregating 24,554 feet, but of three areas drilled, only in the Albert Mines area were results encouraging. In this area it is estimated (Summary of Investigations on New Brunswick Oil Shales, Canada, Department of Mines and Resources, Bulletin No. 825, P.2) that there are "100,000,000 tons to a depth of 400 feet averaging 10.6 gallons, and of this tonnage about 2,000,000 tons average 20 gallons. However, to take out the higher grade shale by open-cut methods would involve excavating 20,000,000 tons of shale and it is estimated that the average oil content of this material would be 12 to 14 gallons to the ton."

More than 30 wells have been drilled in New Brunswick in an attempt to find oil and gas beyond the Stony Creek field, but without success. The deepest well in the sedimentary basin drilled in 1945 to a depth of 14,696 feet, was on Prince Edward Island in the Hillsborough Bay area. The succession was red beds with evaporites and it was not penetrated.

In Nova Scotia a number of wells have failed to penetrate the salt section, even though depths

in excess of 6,000 feet were reached and one well reached a depth in excess of 11,500 feet. Seepages of oil are known to have occurred on Capt Breton Island and oil shales occur in Mississippian and Pennsylvanian rocks.

Newfoundland: In Newfoundland there are several sedimentary basins, but the most promising one is on the west coast near Parsons Pond and St. Paul's Inlet where seepages occur. Actually a few hundred barrels of oil have been produced from wells drilled some years ago. This area recently has been under active exploration.

Some Small Western Canada Basins: Other than the great interior sedimentary basin there are a few small basins that have come under exploration from time to time in Western Canada. Among these is the Flathead area of Southeastern British Columbia with some remarkable oil seepages issuing from Pre-cambrian strata which are overthrust onto Mesozoic and Palaeozoic strata. There is also the Fraser River delta area near Vancouver, where there is an unknown thickness of Tertiary strata believed to be mainly, if not wholly, non-marine, and in which some drilling has been done with reported shows of gas. Sedimentary rocks, mainly of Cretaceous age, occur on the Gulf Islands near the southeast coast of Vancouver Island. Also on the Queen Charlotte Islands, where oil seepages and oil shales are present, there are Tertiary, Cretaceous and Jurassic strata.

In all of these areas a limited amount of drilling has been done and although the prospects are by no means exhausted, they are considered to be much less favourable than in the great interior basin.

The Western Canada Sedimentary Basin: As herein defined the Western Canada sedimentary basin is an extension northwestward of the great interior basin of the United States. It is the area south and west of the Precambrian shield and east of the Cordillera. At the international boundary between Canada and the United States it is about 800 miles wide. In the Peace River area it is about half this amount and 1,600 miles northwest of the international boundary, in the vicinity of the delta of Mackenzie River, it is about 235 miles wide. It consists of the southwest corner of Manitoba, the southern half of Saskatchewan, all of Alberta with the exception of the northeast corner, an area in the foothills in southeastern British Columbia and all of the area east of the mountains in the northeast part of that province, a small part of southeast Yukon as well as Eagle and Peel plateaus and the Porcupine area, the Mackenzie River drainage area between the Precambrian shield on the east and the mountains on the west in the Northwest Territories northward to the Arctic Ocean.

In such a large area there are various ways

in which an estimate of the possible oil and gas reserves may be made. Perhaps the most satisfactory and reliable method is that of estimating the volume of sediments within the basin and comparing this with other sedimentary basins of the world or other areas in a more advanced state of development. Lewis G. Weeks, Standard Oil Company (New Jersey) has for a number of years made extensive studies of this method, and his results have been revised and published (Weeks, Lewis G., "Concerning Estimates of Potential Oil Reserves Bulletin of the American Association of Petroleum Geologists, Volume 34, No. 10, pp. 1947-1953) from time to time. According to him, up to January 1, 1950, the oil discovered in the United States amounted to nearly 64 billion barrels, of which 39 billion had been produced, leaving 25 billion as proved reserves. This amounted to 32,000 barrels of oil per cubic mile in the approximately 2 million cubic miles of effective basin sediments. The figures for the various states as prepared by him at that time, were as little as 6,000 to 8,000 for Kentucky and Indiana, and as much as 200,000 barrels of oil per cubic mile for California. At that time, also, he considered the ultimate for the United States might be 110 billion barrels or 50,000 barrels per cubic mile, and that the world basin areas of approximately 20 million cubic miles might have an ultimate production of

610 billion barrels or 30,000 barrels per cubic mile. This figure of 30,000 barrels per cubic mile has been widely quoted by geologists and engineers to whom it offered a ready yardstick of measurement.

Since 1950, however, Weeks has revised his estimates for the ultimate amount of oil to be discovered in the United States. This has been done as the result of new information, but particularly because of the present assessment of lands under water on the continental shelf. He now considers the ultimate oil to be discovered in the United States will exceed 200 billion barrels. Others, using good supporting arguments, have thought that 250 billion barrels is more probable, and the United States Bureau of Mines has considered 300 billion barrels a reasonable assumption.

These upward revisions have been supported by the amount of oil found. To the end of 1956 the United States had produced 55.2 billion barrels of oil, and the reserves at that time were estimated at 30 billion barrels of crude oil and 5.4 billion barrels of natural gas liquids, or a total of 35.4 billion barrels. (World Oil, February 15, 1957, P. 130.) Thus production and proven reserves at the end of 1956 amounted to 90.6 billion barrels.

In regard to discoveries of natural gas, the figures have had to be revised upward as more

geological facts have become known and a better assessment could be made. The ratio of the rate of gas discovery to oil discovery has had to be increased, since it is now known that there has been "a rise from 4.1 Mcf of gas per barrel of oil reserves found in 1947 - 1949 to 6.5 Mcf per barrel found in 1954-1956." It has also been calculated by Terry and Winger (Terry, Lyon F. and Winger, John G., American Gas Association meeting Lake Placid, May 13, 1957, published by Chase Manhattan Bank) that "based on the estimate of 250 billion barrels of minimum ultimate oil recovery (in the United States) and deducting 86 billion discovered to date, there would remain 164 billion barrels to be found in the future. At 6 Mcf per barrel, this would indicate future gas discoveries of 984 trillion cubic feet. Adding proved reserves of 238 trillion at the end of 1956 indicates a total future gas supply of the order of 1,200 trillion cubic feet which we propose as a reasonable minimum estimate based on present evidence."

It is not possible to get exact figures of total gas production to date in the United States. Only estimates are available prior to 1906 and the amount of waste is unknown. However, to the end of 1956 reliable information (World Oil, February 15, 1957, Pp. 183-184) shows

that marketed production has been about 140 trillion cubic feet. Thus marketed gas to date plus proved and future supply estimates, amounts to 1,300 to 1,400 trillion cubic feet. If the ultimate oil yield is taken as 250 billion barrels, this tends to confirm the opinion that for every billion barrels of oil discovered, it may be expected that there will be about 6 trillion cubic feet of gas, as has been indicated in the more recent years.

Against this background of data from the United States, the most highly developed oil and gas country in the world, a broad assessment of possible gas and oil resources of Canada is feasible. The importance of the estimate will not be in the precision of the amount deduced, provided it is within reasonable limits, but it will be in the magnitude of the reserves which are indicated.

In Canada although limited production may be achieved in any one of a number of sedimentary basins, the only really favourable prospects for large ultimate yields are in the sedimentary basin, which is the northwest extension of the interior plains area of the United States, and in the Arctic Islands.

The sedimentary basin in the western provinces consists of an area 800 miles wide at the international boundary between Canada and the United States stretching from the Precambrian Shield in

Manitoba on the east to the Cordillera on the west. Northwestward this area extends 1,600 miles to the delta of Mackenzie River. At the Arctic coast its width is about 235 miles.

In this area the thickness of sediments in general increases westward or southeastward. For purposes of computing the volume only that area west of the 1,000 foot isopach has been used, as in Figure 2. In the foothills as shown on the map, the volume has been calculated on a basis of 16,000 feet, since wells in this area have already reached depths of 15,000 feet. This does not by any means represent the total thickness of sediments in this area. A planimeter measurement of size of areas and volume of sediments in each is as follows: (These areas are here given separately so that they may be useful where more restricted comparisons of one part of the basin in reference to other parts are desired.)

	SIZE	VOLUME OF SEDIMENTS (thickness 1000 to 16,000 feet)
	square miles	cubic miles
Manitoba and Saskatchewan	176,623	168,072
Alberta Plains	223,697	301,731
Alberta Foothills	13,196	39,984
British Columbia Plains	36,026	70,892
British Columbia Foothills		
South	2,095	6,348
North	12,567	38,078
Yukon	43,000	64,500
Northwest Territories	204,794	267,133
Total for sedimentary basin	711,998	956,738

The average thickness is slightly more than 7,000 feet.

With the above information it is now possible to make estimates of the potential oil and gas reserves in the sedimentary basin of Western Canada as thus defined. It should be noted that these figures are applicable only to the basin as a whole and not necessarily applicable in the same way to individual parts. In reference to world basins, as already indicated, Weeks in 1950 used 30,000 barrels of possible oil for each cubic mile of sediments. His figure for the United States at that time was 50,000 barrels of possible oil for each cubic mile of sediments. This figure has subsequently been revised upward. Thus these figures are now believed to be too low. They, therefore, can be regarded as minimum figures.

On the world basis of 30,000 barrels of

possible oil for each cubic mile of sediments, it is obvious that an estimate for the Western Canadian sedimentary basin of 950,000 cubic miles would be approximately 28.5 billion barrels of possible oil, whereas if the comparison is made with the minimum figure of 50,000 barrels for the United States, the corresponding figure would be approximately 47.5 billion barrels. Again it should be emphasized that these are minimum figures which are too low as applied to the United States.

An estimate of maximum figures would be more hazardous. In the United States a great amount of prolific production has been found in Tertiary strata which in Canada are expected to be generally barren of oil because of their non-marine character. Thus it is not possible to use a direct relationship between the size of the basins in Canada and in the United States. Many other factors also need careful assessment, but based on a possible evaluation of 250 billion barrels in the United States, which is stated by Terry and Winger to be a "minimum ultimate recovery", it would seem that an estimate of 75 to 100 billion barrels would not be too high for Western Canada and might be below maximum possible yields. Thus based on minimum and what are regarded as below maximum estimates it is concluded that the ultimate recoverable oil of the Western Canadian sedimentary basin is of the order of 50

billion barrels. This estimate is exclusive of the bituminous sands of Northern Alberta.

There is another approach by which the validity of the 50 billion barrel estimate can be checked. This is the relationship between wells drilled and the amount of oil found and a comparison between Canada and the United States.

It has been shown (Gonzalez, Richard J., Director and Treasurer, Humble Oil and Refining Co, "U.S. Not Running Out of Oil" World Oil, March, 1957, P.65) that in the United States the development of new oil per well has remained reasonably constant in the 30-year period 1925 to 1955. The figures are as follows:

	1925-35	1935-45	1945-55
New Oil - billion barrels	17.4	20.8	30.9
Total wells completed	220,400	279,700	435,100
New oil per total well	79,000	74,000	71,000
Oil wells completed	127,500	166,400	231,700
New Oil per oil well	137,000	124,000	133,000

This shows that "in terms of results per well drilled only a slight downward trend is evident over the past 30 years and this trend may be checked or reversed for the next ten years by the high results per well expected from offshore drilling".

In Western Canada to the end of 1957 there have been a total of approximately 22,000 wells drilled, resulting in the finding of about 3.8 billion barrels of oil of which 2.8 billion barrels are present reserves of crude oil exclusive of natural gas liquids.

This is a discovery rate of about 170,000 barrels of oil for each well drilled in comparison with the United States figure of from 70,000 to 80,000 barrels over the 30-year period from 1925 to 1955. Since the beginning of the oil industry to the end of 1956 in the United States a total of 1,646,000 wells (World Oil, February 15, 1957, P. 145) had been completed discovering 90.6 billion barrels in oil produced and in proved reserves. This is equivalent to the discovery of about 55,000 barrels per well in comparison with the 70,000 to 80,000 for the 30-year period. In Western Canada to the end of 1957 there were 12,250 oil wells drilled developing approximately 3.8 billion barrels of oil or an approximate total of 310,000 barrels for each oil well. This is in comparison with around 130,000 barrels for each oil well in the United States in the period 1925 to 1955. Thus from the standpoint of both total wells and oil wells drilled, the discovery rate in Western Canada for its short history has been better than in the considerably longer period in the United States. Thus there is a considerable margin of safety in making the assumption that the discovery rate in Canada for many years to come will be at least the equivalent of what it has been in the United States over a long period. On this basis, therefore, and in relation to a comparison of volume of sediments in the two countries, Western Canada's ultimate reserves may be expected to be one quarter to one third those of

the United States.

If the figure of 250 billion barrels is used for ultimate reserves for the United States, then the Western Canadian ultimate reserves, using the more conservative figure of one-quarter, would be more than 60 billion barrels. If the Bureau of Mines' figures of 300 billion barrels is used for ultimate reserves of the United States, then the corresponding Western Canadian figure on the above basis would be 75 billion barrels. The figure of 50 billion barrels for Western Canada, therefore, seems to be in accord with present available information using figures which are conservative.

It has already been shown that a figure of 6 trillion cubic feet of gas is being found in the United States for each billion barrels of oil. In view of the prospects for gas, as already shown by discoveries, and in view of geological opinion, particularly in regard to foothills structures, this figure does not seem too high for Canada. Applied to the minimum figures of 28.5 billion to 47.5 billion barrels of oil, the minimum figures for possible gas reserves would be 170 to 285 trillion for the Western Canadian sedimentary basin. Applied to the more reasonable figure of 50 billion barrels, it would be 300 trillion cubic feet. Even this higher figure of 300 trillion is slightly lower than a quarter of what is being predicted for the ultimate figure in the United States where, in spite of a

considerably greater density of drilling than in Canada, the finding of 24.9 trillion cubic feet (Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas. Vol. No. 11, American Gas Association - American Petroleum Institute. Dec. 31, 1956) of new natural gas reserves during 1956 constituted the largest single discovery year in the history of gas development in that country. It is also reported (World Oil, February 15, 1957, P. 136-7) that "in the period 1951-1956 in the United States 82.5 trillion cubic feet of new natural gas reserves were proven to exist. In the preceding five-year period covering 1946-1950 new gas found totalled 67.3 trillion cubic feet". This is a discovery of almost 150 trillion cubic feet in 10 years. This period corresponds to the decade in which there was a tremendous expansion of the natural gas industry in the United States, and in which the value of natural gas received greater recognition than had previously been the case. There is no doubt, therefore, with proper incentives the natural gas industry of Western Canada can have a similar proportional expansion in the next decade, since it can be stated with a high degree of confidence that the ultimate amount of gas to be discovered in the Western Canadian basin is of the order of 300 trillions of cubic feet.

Possible Sulphur Reserves: The calculations for possible sulphur reserves in Western Canada

are based on the possible gas reserves of 300 trillion cubic feet as worked out for Western Canada. Because of the variation in per cent. of sulphur from area to area -- for example, sulphur percentage in the foothills is generally much greater than in most parts of the plains -- a rough breakdown of possible gas for Western Canada was made to aid in arriving at the sulphur figures.

Then follows a short table, and the figures are expressed in millions of long tons.

	Sulphur (Millions Long Tons)
Manitoba & Saskatchewan	5
Alberta - Plains	65
-Foothills	125
British Columbia	35
Yukon & N.W.T.	30
TOTAL	260

The above sulphur reserves do not take in the huge amounts of sulphur in the McMurray oil sands. Using a figure of 150 billion barrels of oil and 4 to 5 per cent. sulphur, 60 per cent. recoverable, would result in a figure of approximately 900 million long tons of sulphur for McMurray oil sands.

Then on the next page there is a map of North America which outlines the sedimentary basin.

MR. PROCTOR: Shall I go ahead with the tar sands now, sir?

THE CHAIRMAN: Yes.

MR. PROCTOR: The Athabasca Bituminous

Sands: The bituminous sands of the McMurray, Alberta, area are 300 miles northeast of Edmonton. The first white man known to have seen them was Peter Pond in 1788. Since that time they have been a source of wonder and amazement to many explorers and scientists. They are exposed in the valley of Athabasca River and on its tributaries for a distance of 42 miles above McMurray and 76 miles below it. Prominent cliffs along the Athabasca River ooze a thick tarry bitumen on warm summer days and even a casual observer cannot fail to be impressed by the magnitude of the oil deposit. Actually its size is not too well known. At McMurray and in places along the Athabasca River to the north, the base of the bituminous sands is exposed in contact with Devonian limestones, but south and west the regional southwest dip causes the sands to become covered by progressively thicker younger strata. The last outcrop upstream on Athabasca River is, therefore, the top part of the formation. Drilling beyond the limits of the exposures has given some additional information, but only a few wells have penetrated a section comparable to that exposed and, as far as known, all wells have encountered much thinner sections. Thus the deposit wedges out south and west as it does also to the east. This is to be expected, since the sands in which it occurs form a deltaic Cretaceous deposit probably laid down at

the mouth of a large river originating in the Precambrian shield to the east.

S.C. Ells (Ells, S.C., Department of Mines, Mines Branch, Bulletin No. 632, 1926, P.16) of the Mines Branch, Department of Mines, Ottawa, did much work in mapping, sampling and testing the bituminous sands by shallow auger holes. He stated that "the direct distance in a north and south direction through which outcrops have been noted, is approximately 115 miles, and that from east to west approximately 55 miles". It should be noted that this is only the exposed part. According to Max Ball, (Ball, Max W., "Development of the Athabasca Oil Sands", Transactions, Canadian Institute of Mining and Mettalurgy, Volume 4, 1941, P.64) who for many years carried out operations at McMurray for Abasand Oils Ltd., the areal extent is 10,000 to 30,000 square miles. A bed 100 feet thick with a bitumen saturation of 10 per cent. contains 133,000 barrels an acre or 85,120,000 barrels per square mile. The maximum thickness (Hume, G.C., "Results and Significance of Drilling Operations in the Athabasca Bituminous Sands." Transactions, Canadian Institute of Mining and Metallurgy, Volume 50, 1947, P. 312,323) of the deposit, as far as known, is 224 to 229 feet, all high-grade material, recorded in holes B.17 and B.33 in the Mildred - Ruth Lakes area, about 22 miles north of McMurray on the west side of Athabasca

River opposite the mouth of Steepbank River. In many areas, however, as shown by drilling, even where the total thickness of the bituminous sand formation may approach 200 feet, there are bands of clay in places of very considerable thickness, interbedded with sands containing variable amounts of bitumen. All these conditions make an estimate of the total content of bitumen very difficult and in consequence, not too precise. It is thus not surprising that the most reliable estimates place the bitumen content in the order of 100 to 300 billion barrels, with perhaps 250 billion barrels the preferable figure (Pratt, Wallace E., "Oil in the Earth", University of Kansas Press, 1943, P.41). The amount of bitumen in this deposit, therefore, may exceed the known free world's proven oil reserves, which, as of January 1, 1957, were considered (World Oil, August 15, 1957, P.199) to be 207.5 billion barrels.

In regard to fuel value 100 billion barrels of oil is equivalent to 24 to 25 billion tons of coal. This is about the amount of recoverable coal estimated by Mackay (Report of the Royal Commission on Coal, 1946, P.11) for the reserves of Alberta. Thus the minimum reserves of oil in the bituminous sands is equivalent in heat value to all the recoverable coal in Alberta.

Extensive drilling of the bituminous sands

was undertaken during the war by the Department of Mines and Resources, Ottawa, at the request of the Oil Controller for Canada. A number of areas north of McMurray including the Horse Creek reserve, were tested. The drilling in 1942 was by auger hole method, which was not satisfactory, and from 1943 to January 1947, core drilling, which had been perfected, was used in drilling 291 holes for a total of 53,918 feet. Certain requisites were considered necessary for a possible commercial deposit, which was then envisioned as an open-cut mining operation. These were, briefly:-

(1) A small thickness of overburden.

(2) Sands with low clay content and bitumen content of not less than 10% and preferable greater than 12%.

(3) Continuous thickness of sands without extensive interbedded bands of clay.

(4) Favourable plant site area, and

(5) Adequate tailing disposal area.

The results of drilling indicated a surprising variation in the bitumen content from place to place, and even in the same deposit. The most favourable conditions found were in the Steeprock River area and in small areas on Horse River, but particularly in the Mildred - Ruth Lakes area, 22 miles north pf McMurray. The area at the plant at Bitumont was not tested.

The Mildred - Ruth Lakes area proved to be phenomenally rich. In parts of it the drill holes were on a quarter of a mile spacing, and in other parts one-half mile. In a limited area the quarter-mile spacing was supplemented by a hole in the centre of the quarter-mile area, as well as a hole at each quarter-mile corner. The amount of bitumen was found to vary from a few per cent. to bitumen beds in the sands containing 77.8% bitumen. For these richer beds all assays were calculated as 19%, the theoretical maximum content where the sand grains would be in contact with one another. In outlining the Mildred - Ruth Lakes area a total of 73 wells from 125 to 300 feet deep were drilled in an area 8 miles long by 2 miles wide. Forty-eight of these holes were concentrated in an area of 2 1/2 square miles. Nine wells more widely spaced were drilled south of the more favourable area, increasing its size to 4 1/2 square miles. In this a calculation based on all assays (using 19% as maximum) showed there are 900,000,000 barrels of bitumen. These, then are proven reserves in this area amounting to 200 million barrels per square mile for the 4 1/2 square miles in which the content was appraised. It was found that the sands in this area have an average of 13.6% bitumen and that the ratio of bituminous sands to overburden is 2.6 to 1. This, then, is a rich deposit that fits all the requisites for possible commercial

use. There is a limestone bench about a quarter to a half-mile wide between the escarpment face of the deposit and Athabasca River, which would provide an adequate plant site. The deposit is wholly above river level, which would simplify drainage in open pit mining. Also all material from the deposit would be transported down to the plant, which would not be the case where a plant site had to be made on the top of a deposit as in some other areas.

Since the Mildred - Ruth deposit was outlined by drilling, a number of oil companies have taken permits on areas of bituminous sands and have done drilling. It is known that some of these programs have met with satisfactory results, even though equally rich deposits over such a large area as that on the Mildred - Ruth Lakes area, may not have been discovered. Thus although there are no total figures for proven amounts of bitumen, they are probably large. Actual figures, however, would not be significant unless the grade of material and the amount of overburden was known, because a proven deposit might have no value if conditions were prohibitive for open pit mining, which up to now has been considered to be the method most likely to be used in any development. Open pit mining has many disadvantages, and there is no doubt that extraction in situ would constitute the ideal method which would make the thousands of square miles available for development, instead of the possible 10 to 20 square miles, as estimated by Max Ball (Ball, Max W., "Development of the Athabasca Oil Sands," Transactions, Canadian Institute of Mining and Metallurgy, Volume 44, 1941, P.66) if open pit mining is considered obviously only the proven bitumen within this small area in sands of sufficient grade to be commercial under small overburden, would have any importance. The amount of bitumen in this, however,

would still be reckoned in billions of barrels.

Methods of extraction in situ rather than by open-cut mining would change the whole situation and make at least 100 billion barrels the minimum estimate for the deposit, available for development. Such methods of extraction are believed to be under serious laboratory investigation, but so far no application has been attempted. The problems of extraction and treatment of the bitumen are only a part of the difficulties. The percentage of bitumen in a deposit is commonly calculated by weight. Thus when a deposit is said to contain 15% bitumen, the other part is 85% sand with variable amounts of clay. The sand, when the bitumen is extracted, is clean and white and much of it is very fine. It could be handled from a plant as a sludge in water through a pipeline, but its confinement to a disposal area might involve high expenditures. The necessary measures would have to be taken to see that the sand did not reach the Athabasca River, where shifting sandbars are now a problem of navigation at certain stages of water. Also the sand when dry would be airborne by the wind, so that perhaps some form of a consolidating agent would have to be provided to hold it. As a sludge it would be expensive to tr and put it back in the mined out area, unless unmined bituminous sands were left as walls to retain it. This would reduce the

mineable sands in any area by a considerable amount and thus leave behind an appreciable volume of bituminous sands that would never be recovered, a method that would not be considered good conservation practice. Thus removal of the bitumen in situ is desirable, even though the recovery would not be complete.

The layman is often puzzled as to why the bituminous sands are not now being developed. The answer is largely twofold; namely, mining extraction and treatment methods, that is, the necessary techniques and overall costs. There is no doubt at the present time that if an emergency should arise where costs were considered of less importance than production of oil, sufficient information and knowledge is available for mining the sand and designing plants for the extraction and treatment of its bitumen content. It has been considered (Blair, S.M., Report on the Alberta Bituminous Sands, Government of the Province of Alberta, 1950) that the economic plant size would be 20,000 barrels a day, but this need not necessarily be so. However, to attain a commercial operation it might be necessary to operate not less than 5 such units and thus privide 100,000 barrels a day in order to afford economic transportation by pipeline to the nearest point where other pipeline facilities could be used to market the oil. In this case the nearest outlet would be

Edmonton and the Interprovincial and Trans-Mountain pipelines. Such an operation thus involves a treatment plant in the bituminous sand area which would refine the bitumen only to the stage where a crude oil would be available for pipeline transportation. In this process the 5% sulphur content would be eliminated.

The building of one to five 20,000-barrel-a-day units would take considerable time and involve large capital expenditures. Perhaps part of the reason why no attempts have been made so far to put a plant in operation, is the fact that obsolescence of such a plant might be very fast due to rapidly improving techniques, particularly in the refining industry. The matter of cost in terms of only a few cents a barrel is vital. For example, if the assumption is made that the unrefined bitumen taken from the Mildred - Ruth Lakes deposit has a value of $1.00 a barrel, a reduction of each cent in costs for the 900,000,000 barrels involved means 9 million dollars. Under such conditions a pilot plant operation for a limited time is highly desirable, but such a pilot plant must be on a reasonable scale, in which case the disposal of the crude pipeline oil thus produced becomes a major expense in the period pending a commercial operation.

These are only a few of the problems facing the development of the bituminous sands. They have

been outlined here briefly because they completely overshadow the problem of the amount of established or possible reserves. The Mildred - Ruth Lakes deposit is sufficient for a 100,000-barrel-a-day operation for nearly 30 years, and there are other valuable and rich deposits at Bitumont and elsewhere. Thus there is no problem in the availability of large volumes of rich sands. An in situ extraction method, however, if such is devised, could operate south of McMurray and hence avoid some costly transportation problems such as the crossing of the Athabasca River, unless it is decided to build the proposed railroad to more northerly areas via McMurray, rather than by one of the other routes that have been considered. At the present time there is also the difficulty of availability of a market for crude oil produced in Alberta. A plant to produce crude oil from the bituminous sands would probably take two to five years to complete after the decision had been made to proceed with such a development. This, then, brings up the problem of the availability of future markets for crude oil, and it would seem almost certain unless some solution is found, that the incentive for present development of the bituminous sands will be lacking. This, of course, does not mean that further investigation of cheaper production and treatment methods will not be studied. Progress will, however, only be made because of the firm belief that

in the next decade or so oil will be in demand in ever-increasing amounts, and that a larger share of the market than now will be available for that produce in Alberta. This assumption, however, may need careful analysis. Rapid changes are taken as inevitable. The widespread and abundant use of oil and natural gas has given the coal industry in Alberta almost a solar plexus blow. There are reliable reports of the near introduction of cheap energy by nuclear fusion, which might conceivably be a sharp competitor in the near future to oil and gas for certain purposes. There is no doubt, however, that oil will retain its favoured position long after nuclear power has been made available, and if markets are established, they will not be lost. On the other hand, it would appear that the competitive position of oil and gas in the markets of tomorrow in reference to other sources of energy, could become much more severe than it is in reference to sources of energy in the markets of today, so that the problem of the establishment of markets and their retention is of paramount importance in providing an incentive for the development of the bituminous sands which, with the exception of radioactive deposits and excluding coal, is the greatest source of energy available in Canada. The problem of the bituminous sands, therefore, if they are to be developed, is not one of reserves, but of incentive

for development, and this incentive can only be provided by assured future markets for oil and gas.

THE CHAIRMAN: Thank you very much, Mr. Proctor. I think we will have a ten-minute break.

---A short recess

THE CHAIRMAN: Gentlemen, may we resume our hearing.

Mr. Thomson, will you continue?

MR. TURNER: Mr. Chairman, I would like to point out, before Mr. Thomson commences to read this section of the brief, it is not intended that this section would apply to the lands held by the major railway companies and Hudson's Bay. We felt they may wish to comment on their own lands.

THE CHAIRMAN: Thank you.

MR. THOMSON: Freehold Lands: The term freehold as used herein applies to mineral rights owned by individuals but is not intended to apply to the mineral holdings of the two major railway companies and the Hudson's Bay Company, nor does it apply to the sizeable holdings of smaller land holding companies such as the Calgary and Edmonton Corporation. All of these rights are the result of homestead purchases from the Federal Government, the railway companies and the Hudson's Bay Company, made in the latter part of the nineteenth and very early years of the twentieth century. These main land

holding bodies began reserving mineral rights to themselves between the years 1887 and 1905. Thus a present-day freehold mineral map provides an accurate picture of the history of Prairie Settlement up to the early part of this century.

Although accurate figures are extremely difficult to calculate it is probable that individual or farmer-owned minerals in the sedimentary basin of Western Canada total some 30 millions of acres. While this total acreage is small, representing as it does only 6 or 7% of the total acreage in the basin, its geographic distribution has given it an importance disproportionate to its volume. This is the result of the early discoveries in the "fairway" area of Alberta which is an area running from a few miles northwest of Edmonton, southeasterly through the Camrose and Stettler districts, and later intensive exploration and development in what is commonly referred to as the Souris Valley of southeastern Saskatchewan. The Edmonton and Souris Valley areas are areas of early settlement and therefore contain a relatively high percentage of freehold minerals. Conversely, of course, there is no freehold acreage in the northern parts of Western Canada, the Northwest Territories and the Yukon. Thus, while freehold acreage if evenly distributed throughout the sedimentary basin would amount to about two sections per township, in the areas of early settle-

ment it runs as high as 14 to 18 sections per township.

Freehold or farmer-owned minerals do therefore play an extremely important part in the overall land picture.

The oil industry in Western Canada has for the most part adopted the "unless" type of lease. This form of lease is the evolutionary result of many years of experimentation in the United States, where the predominance of freehold ownership in the oil-producing areas has necessitated the development of a form of lease which is mutually satisfactory to the owner and the industry.

Basically, the "unless" type lease provides a short definite term, commonly ten years, with a proviso that the lessee shall either commence drilling within a stated period, usually one year, or pay rent, but he is not obligated by his contract to do either. Failure to drill or pay the rental automatically terminates the lease. A "thereafter" clause extends the definite term for the producing life of the property.

The lease provides for a gross royalty to the owner of a stated percentage or fraction of production, usually one-eighth, and usually contains express covenants to protect the land from drainage.

Most of the negotiations centre around the bonus or consideration paid for the granting of

the lease and this amount varies widely depending on the stage of exploration, proximity to production, etc. In the early stages of exploration in Western Canada 10¢ per acre was a not uncommon amount. Following the discoveries in Alberta in the years 1947 to 1950 industry competition and the ordinary application of the law of supply and demand resulted in a sharp increase in the price of freehold acreage and $100,00 per acre was not uncommon for land which was highly speculative, or in industry terminology "wildcat" acreage.

As stated previously, the definite term commonly used is ten years, but this is one of the negotiable features of the lease and may be varied if circumstances warrant.

Generally speaking, it may be stated that the mineral owner is offered the fair "going rate" for a lease of his minerals for a definite term and is paid an annual rental during that term if the lessee fails to drill. He is assured of protection against drainage of his property and receives a gross royalty of one-eighth of the proceeds from production from his land.

In addition it is general practice in Western Canada to pay the mineral owner an additional separate amount for the use of the surface of his land for the purpose of drilling wells and erecting production facilities.

There are, of course, variations of the basic lease form and there are other types of Petroleum and Natural Gas Leases in existence, but for purposes of this brief no attempt has been made to catalogue these. This outline is intended to illustrate generally the basis on which the industry deals with the individual freehold owner of petroleum and natural gas rights in Western Canada.

Production and Conservation. Maximum Permissible Rates of Production: It has been mentioned that the amount of oil which will be recovered from a reservoir is a function of several things. One of the most important of these is the nature of the forces acting within the system. Another parameter which may be very significant is the production rate. Experience has shown that excessively high production rates can reduce the recovery efficiency appreciably below what it would be if lower rates were used. In the case of oil fields this effect is most serious where high rates cause large volumes of gas or water to enter the producing well directly from a gas cap or aquifer. Once these fluids have gained entry to a well bore their paths often cannot be blocked by remedial measures and they will continue to be produced to the exclusion of crude oil. This phenomenon, known as Fingering or Coning, results in wasteful use of the available energy and can prematurely lower the oil production rate below the economic level and force abandonment earlier than would otherwise have been necessary. The same situation is true in gas reservoirs that are underlain by water.

Conservation agencies in Western Canada recognize that production rates must be controlled to prevent wasteful practices. Each of the four western provinces has regulations designed to limit the production rate from an oil well to a level

which is considered safe. These upper limits are referred to as Maximum Permissible Rates or MPR's. They are functions of the reservoir rock and fluid characteristics, the type and strength of the drive mechanisms, the well spacing, and the portion of the reservoir that has been developed. British Columbia, Alberta, and Manitoba assign each well in a reservoir the same MPR which is calculated using average characteristics for the reservoir in question. Sasktachewan makes a separate MPR calculation for each well based on the properties of that well. The formulae used by the different Provinces are essentially the same and involve comparing the characteristics of a particular reservoir or well to the properties of a standard well. The resulting answers are generally a good indication of the upper limit of a well's ability to produce efficiently. The method is particularly valuable in the early life of a reservoir when little is known about the various properties that affect recovery.

As more is learned about the characteristics of an oil reservoir and the forces acting within the system, it is often possible to make a more accurate calculation of the safe production rate using engineering principles and experience. When this approach is employed the answer that is obtained is the Maximum Efficient Rate, which is defined

as the highest rate that may be maintained for an appreciable period of time without creating substantial waste. This value, commonly abbreviated MER, should not be misconstrued as a most efficient rate -- it is regarded as the upper limit of a range of efficient rates. Any increase above this limit will cause avoidable waste; whereas any decrease will not significantly raise the ultimate recovery. When an MER calculation has been accepted by a conservation agency, the value will then be published as the official MPR for the oil wells or pool in question.

The situation with regard to establishing maximum rates of production from gas wells is not as clearly defined. Alberta has an MPR formula for gas wells but this has only been applied in two fields. In the remaining fields it is apparently the practice that any maximum rates are established in meetings between the Conservation Board and the operators. In British Columbia the maximum production rate is made equal to 25 per cent of the well's absolute open flow potential.

Since oil and gas occur together, it is possible to have a conflict of interest between the operators in an area where an oil reservoir is in contact with a large gas cap. Those who will derive a majority of their income from gas sales might wish to see the gas produced as quickly as possible, even

if such production will lower the ultimate oil recovery. On a unit-volume basis, oil is considerably more valuable than gas. Also, it is known that if the gas cap is in good communication with the oil zone, the recovery of oil will be greatest if all gas is retained in the system until the oil zone has been depleted. On the other hand, production of oil will not lower the amount of gas that can be recovered. Thus, as a general rule it is assumed that oil production will take priority over gas. However, in the special case of an extremely large gas cap in contact with a very small oil reservoir, it is possible that some gas production would be permitted, if it could be shown that the value of any lost oil recovery was insignificant.

Productivity and Prorationing: One of the fundamental necessities for conservation is that the volume of oil and gas produced must not exceed the market demand. The present situation in Western Canada is that the demand for Alberta crude oil is less than the Provincial productivity. As a result, the available market must be prorated among all fields in Alberta. Prorationing is not yet considered necessary by the other Provincial Governments.

In Alberta, and other provinces, the total productivity of an oil reservoir is not necessarily equal to the sum of the MPR's for each well in that

reservoir. In some cases the MPR assigned to a well will be much higher than that well's ability to produce. While these values are calculated using the best data available, it is possible that a local condition, such as low permeability or a tendency to cone water or gas, may prevent a well from being able to produce efficiently at its MPR. The unused portion of such a well's MPR cannot be transferred to another well. In addition to this, the production allowables may be subjected to penalty factors if excess volumes of gas or water are produced and not re-injected. The combination of these two factors can have a significant effect on the productivity of a reservoir. The Oil and Gas Conservation Board of Alberta regularly makes estimates of the Provincial productivity. We are informed that this averaged 756,000 barrels per day during 1957.

The following tabulation gives the average 1957 production rate and productivity for each of the four western provinces:

Province	Average Production Rate-barrels/day	Average Productivity barrels/day
British Columbia	1,000	1,200
Alberta	376,000	756,000
Saskatchewan	101,000	125,000
Manitoba	16,700	17,000
TOTALS	494,700	899,200

These **figures** show that the average Western Canadian productivity was 899,200 barrels per day during 1957. The average production rate of 494,700 barrels per day was equivalent to 55 per cent of capacity. Considering Alberta alone, the tabulation indicates that the average production rate of 376,000 barrels per day was 50 per cent of capacity.

MR. PROCTOR: Recovery Methods: The oil reserve figures quoted above were calculated using recovery efficiencies based on present methods of depleting reservoirs. The amount of oil which will be recovered from a pool is a function of many things among which are the characteristics of the reservoir rock, the characteristics of the crude oil, and the type and magnitude of natural or induced forces acting within the system. With regard to this last point, it has been discovered during the past 25 years that the recovery efficiency can often be increased by injecting fluids into a reservoir system. Several of these methods are being used

in Canada at this time. In addition to these well-known and tested methods, there are several new approaches to increasing recovery that are still in the experimental stage. Therefore, any discussion of recovery methods may be logically broken into three parts; namely, primary recovery methods, present methods for increasing recovery and new methods for increasing recovery.

These sections will deal only with oil and not natural gas since there are no techniques employed to increase the excellent recovery efficiencies that may be attained by properly using the natural forces within a gas reservoir.

Primary Recovery Methods: The first step in producing oil requires that the reservoir fluid be moved from its place in the porous rock to the well bore, where it can be taken to the surface. This movement can only be accomplished by an expenditure of energy. Three major natural sources of energy exist. They are expansion of a water-filled zone or aquifer, expansion of a gas cap and expansion of the reservoir oil and its dissolved gas. Under certain favourable circumstances, the force of gravity will have a significant influence. The recovery of oil from a reservoir is a function of the reservoir rock and fluid characteristics but is governed primarily by the nature of the available

energy and the manner in which it is employed during depletion.

When the major source of energy is derived from expansion of gas which was originally dissolved in the reservoir oil, the production mechanism is termed Solution Gas Drive. This is the least efficient depletion method and recovery will vary from only a few per cent in the worst cases to approximately 30 per cent under ideal conditions. The average recovery efficiency is generally considered to be 10 to 20 per cent. If a large gas cap is in good communication with the oil reservoir, the production mechanism will be Gas Cap Drive. This is a better depletion method and recovery efficiency will vary from 25 to 75 per cent, depending on conditions, and will average approximately 50 per cent. The third major depletion mechanism is referred to as Water Drive. This will result when the oil reservoir is well connected to a large, permeable, water-filled zone. In this case, also, recovery efficiency will vary from 25 to 75 per cent and will average approximately 50 per cent. The movement of fluids due to the force of gravity is seldom large enough to account for a major part of the driving energy. However, the presence of these forces in thick, permeable formations will often cause a significant modification of the naturally-occurring depletion mechanism. It very often happens that two or even

all three natural drive mechanisms are operative in the same pool. When this occurs the depletion mechanism is said to be Combination Drive.

Examples of reservoirs whose major natural drive mechanism is Solution Gas Drive are Joffre, Viking, Pembina and Steelman. There is no major field in Canada that relies solely on a natural Gas Cap Drive but reservoirs such as Bonnie Glen D3, Westerose D3, and many of the small Viking, Lower Cretaceous, and Mississippian pools draw a majority of their energy from gas caps. These may be more properly classified as Combination Drive reservoirs. Fenn-Big Valley, Redwater, and Ingoldsby are examples of pools being depleted primarily by strong water drives. The effects of gravity segregation will be quite beneficial in many of the large limestone reservoirs because of their large productive thicknesses and high permeabilities.

In Canada, recovery efficiencies that will be experienced from using only the natural driving forces will range from a minimum of only a few per cent where very thin oil zones are encountered, up to a maximum of approximately 70 per cent in some thick, permeable limestone pools with Gas Cap and Water Drives assisted by gravity segregation. It is believed reasonable to estimate that the average recovery will be 30 to 35 per cent of the oil in place.

Present Methods for Increasing Recovery: During recent years great progress has been made in the ability to analyse the behaviour of a reservoir using mathematical or electronic techniques. This ability has led to a better understanding of the forces acting within a reservoir which has permitted accurate studies to be made showing how these forces may be employed to yield the optimum recovery of oil. The obvious conclusion reached from early studies was that the introduction of energy from an external source might increase recovery. The first large-scale applications of this theory were carried out in fields that had reached total depletion mainly by Solution Gas Drive. Since these fields had already been depleted by primary recovery methods, the phrase "secondary recovery" was created to describe the new processes. As the ability to predict the destiny of any field improved, it became apparent that in most cases the injection of gas or water would create greater benefits if it took place before the point of primary depletion had been attained. In view of this improved approach, the term "secondary recovery" has lost much of its former universal popularity, and it is now common to refer to the processes as "assisted recovery projects" or "injection projects."

The fields in Western Canada are comparatively young and no large pool has been completely depleted. Therefore, no large secondary recovery

projects are in operation, but there are many assisted recovery or injection projects.

These projects involve the injection of water or gas into the producing formation. The quantities injected may range from the return of the gas or water produced with the oil to the use of sufficient supplemental gas or water to maintain the reservoir pressure at a predetermined level or even to cause an increase to some higher level. An important factor in the initiation of a disposal program for returning produced gas or water to the producing formation may be the desirability of conserving the gas or preventing contamination by surface disposal of the salt water. In any case, however, return of produced gas or water results in conservation of reservoir energy which would otherwise be dissipated. Conservation agencies in Western Canada recognize this problem by reducing the oil production allowables for wells that produce salt water or excess gas which is not re-injected. Penalties are waived when re-injection takes place. Most large fields with any significant water drive have water injection projects in operation. The largest is at Redwater where as much as 20,000 barrels of produced salt water are returned to the formation daily.

Gas or water from extraneous sources may also be injected to supplement the energy available in the reservoir. The location of the injection wells is dependent upon reservoir geometry and rock characteristics. In many cases these wells may be located on a five spot pattern in which injection and producing wells alternate. As the permeability of the formation increases, it is possible to have more producing wells per injection well, and either a nine spot pattern, or a line pattern is used. In the ideal case, gas will be injected entirely into the gas cap and water into the aquifer outside or below the oil productive portion of the reservoir.

Substantial portions of the Pembina field are being subjected to a five spot water flood, and smaller areas are installing nine spot projects. A line flood is operating in the Joffre-Viking pool. A pressure maintenance project involving the injection of water into the aquifer below the oil zone is in operation in the Leduc D-3 pool, while pressure maintenance in the Golden Spike South D-3 pool is being implemented by injection of gas into the gas cap.

The beneficial effects of these injection projects vary over a considerable range. Return of the produced water or gas is the least effective, resulting in increased recoveries of only a few per cent. of the oil in place on the average. Full

pressure maintenance may result in an increase in recovery of 30 per cent. of the oil in place, while the results of flooding operations will usually fall between these extremes. If all possible injection projects were undertaken, it is believed reasonable to estimate that the average recovery efficiency would be increased to about 45 per cent. of the original oil in place.

New Methods for Increasing Recovery: The recovery methods discussed above, whether natural or induced, all rely on the ability of gas or water to flush oil to the well bore. The most efficient of these processes can yield recoveries as high as 75 per cent. with an average efficiency of approximately 45 per cent. Recent papers in the literature indicate that many petroleum research laboratories are experimenting with entirely new concepts of increasing recovery. It is claimed that these methods may increase recovery from certain fields to almost 100 per cent.

These new methods rely in part on the flushing ability of an injected fluid but a majority of the improvement is made possible by actually changing the characteristics of some of the crude oil while it is still in the reservoir. This change may be accomplished by adding large volumes of heat to crude oil or by directly employing a light hydrocarbon such as propane to act as a solvent. The

required volume of heat may be injected by employing hot gasses or it may be generated by actually burning some of the crude oil while it is still in the reservoir. This latter approach, called in situ combustion, requires the injection of air so that combustion can be maintained. Fundamentally the process relies on the heat to lower the viscosity of the crude oil so that it may be flushed more readily. The heat will also distill some of the lighter hydrocarbons from the oil which in turn will establish a solvent bank. The heavy ends left behind will act as fuel for the burning process.

The second approach is generally referred to as solvent extraction or miscible displacement. This involves driving a bank of light hydrocarbons through an oil reservoir by means of fluid injection. In some cases it is possible to inject liquid propane and propel this with natural gas at high pressure. In other cases, it is possible to create the solvent bank by injecting high-pressure natural gas containing significant quantities of light hydrocarbons.

Since no large-scale projects have yet been attempted, it is not possible to even estimate what the ultimate effect of these processes will be. However, their potential value is very large when it is considered that approximately 55 per cent. of all the oil discovered in Canada will not be produced by presently known and tested recovery methods.

From the previous discussion it is apparent that the portion of oil within a reservoir that will not be recovered by primary production methods will vary from a minimum of 25 per cent. under favourable circumstances to a maximum of 90 per cent. or more where conditions are very unfavourable.

The volumes of oil represented by these figures are quite large for many reservoirs and assume immense proportions for the country as a whole. It has been estimated that the volume of recoverable oil which will ultimately be discovered in Western Canada will be approximately 50 billion barrels. These figures were obtained by using published data based on experience in the United States. Since the average recovery efficiency presently being experienced is considered to be approximately 30 to 35 per cent., it follows that the total amount of oil in place which will be found in Western Canada will probably be about 150 billion barrels.

MR. THOMSON: Gas Processing: The purpose of the discussion which follows is not to present the detailed technical aspects of gas processing operations -- rather, it is intended to provide general information relating to the overall functions of natural gas processing plants, to furnish statistical information relating thereto; and to provide an insight to some of the factors which govern or

influence the installation and operation of such facilities.

Gas Processing Plants: Casinghead gas, produced in conjunction with crude oil, as well as unassociated natural gas produced from gasfields, contains in its natural state varying amounts of water vapor, hydrocarbons which are extractable as liquids, and oftentimes other objectionable impurities such as hydrogen sulphide, carbon dioxide, etc. Unlike crude oil, gas as produced in its natural state, normally is not suitable for pipeline transmission over long distances. Since pipelines afford the only economically feasible means of transporting natural gas, the gas must be subjected to treating processes to remove these objectionable substances so as to yield "dry" and "clean" residue gas which conforms to rigid specifications limiting the maximum tolerable content of such substances. This treatment, which constitutes the most common function of gas processing plants is, of necessity, performed at or near the point of production of the gas.

While the above-mentioned substances cannot be tolerated in gas which is to be transported and marketed as fuel, certain of these constituents upon further processing in a plant, yield valuable "by-products".

Generally speaking, the so-called "by-products" most commonly available as saleable products

from gas processing plants are commercial propane, commercial mixed butanes (iso-butant and normal butane) mixtures of propane and butanes (all of which are commonly referred to as liquefied petroleum gases or LPG's) and natural gasoline. In some instances, however, liquid or gaseous ethane as well as liquid iso-butane are available as plant products. In addition, in those instances where the produced gas contains significant quantities of hydrogen sulphide, elemental sulphur is often derived therefrom as a saleable plant product.

Significant technological advances have been made relative to methods of processing gas for liquid recovery during the past 20 to 30 years. The two processes used most widely today by the industry are the"absorption process" and the "refrigeration process".

The absorption process entails intimately contacting the natural gas at elevated pressures with low-boiling range oil (called absorption oil) which absorbs certain of the liquid constituents of the gas. The enriched oil stream is then heated and s tripped of the absorbed liquids. The unstabilized liquid hydrocarbon mixture recovered thereby is then further processed by fractionation to effect the separation of the mixture into its various saleable components -- propane, butanes and natural gasoline.

The refrigeration process entails cooling the natural gas at elevated pressures by means of a refrigerant such as propane or ammonia to a low temperature in the range of minus 10° F. At these conditions certain of the liquid constituents of the gas are separated as an unstabilized liquid hydrocarbon mixture. Through fractionation, the mixture is separated into its various saleable components.

While higher percentage recoveries of ethane, propane and butanes can usually be realized through application of the absorption process, both of the above-mentioned processes are relatively efficient. Generally speaking, it is not uncommon for plants utilizing either process to be designed to recover approximately 50 per cent. of the propane, 85 per cent. of the butanes and essentially 100 per cent. of the natural gasoline constituents as contained in the "raw" natural gas.

Several different process have been employed over the years in the treating of "sour" natural gas to remove therefrom hydrogen sulphide and carbon dioxide (called "acid gases"). However, the process most widely used today by the industry entails intimately contacting the sour gas with an amine solution which has an affinity for these acid gases. The amine solution, after having removed the acid gases from the natural gas, is heated and stripped of same. The regenerated amine solution is then available for re-use in the process. This process removes essentially all of the acid gases from the natural gas.

The acid gases evolved by regenerating the amine solution are flared or, if economics justify, they are supplied to a sulphur recovery plant wherein through an oxidation process, elemental sulphur is derived from the hydrogen sulphide gas. In excess of 90 per cent of available sulphur is thereby normally recovered as a plant product.

An operation termed "dehydration" is performed in gas processing plants for the purpose of removing water vapor contained in natural gas. The removal of such water vapor is necessary to prevent formation of hydrates or ice with consequent plugging of lines; to prevent accumulation of water in transmission lines which reduces capacity; and to prevent corrosion of equipment. Dehydration is

also practised on propane streams to prevent freeze-ups which would otherwise occur when propane is vaporized for use in homes or commercial installations.

There are many methods and combinations of methods which are capable of accomplishing dehydration. However, except in certain specialized services, the principal dehydration methods are (1) solid desiccant dehydration, which employs beds of a granular material that can be regenerated by driving off absorbed water at elevated temperatures, and (2) liquid dehydration, which involves circulating a concentrated solution of glycol over a contactor through which the gas is passed. The water absorbed by the liquid is removed by distillation in a separate regenerator column.

In many instances, it is necessary that natural gas be dehydrated even before it is introduced into a gas gathering system for delivery to a plant for processing. Even in such instances, it is often necessary, dependent upon the particular treating processes to which the gas is subjected in the plant, that the dehydration operation be repeated at the plant in order to obtain a "dry" residue gas which is suitable for delivery to a gas transmission pipe line.

While the foregoing description of the treating processes to which natural gas is subjected

in gas processing plants has purposely been presented in simple terms, it should be recognized that the operations are quite complex and require the installation of a great variety of types of costly equipment. The natural gas to be handled in a gas processing plant must, of course, be gathered from the various points of production in the field and delivered to the plant. The extent of such gathering facilities is dictated by the particular circumstances -- the gathering system may involve installation of a few miles of pipe lines or several hundred miles of pipe lines ranging from small to large diameter pipe. The plant proper normally includes such major facilities as gas compressors, large vessels, processing towers such as fractionators, product storage tanks, steam generating and distribution facilities, electrical generating and distribution facilities, heat exchangers, pumps and drivers, instruments and controls, buildings, laboratory facilities, etc.

Numerous factors are involved in the determination of the gas handling capacity which is to be provided in a particular gas processing plant. In this connection, it might be well to point out a basic factor which differs as between processing plants required for handling of casinghead gas and those required for handling natural gas produced from gas fields.

The production of casinghead gas from an oil field fluctuates from day to day and from month to month depending upon the amount of oil being produced from the field. That is to say, the production of casinghead gas cannot be controlled directly at any given time. In those instances where the installation of a casinghead gas processing plant is prompted primarily by conservation measures, the capacity of the plant is established so as to effectively conserve the gas contemplated to be produced, having due regard to projected oil producing rate from the field. Obviously then, the economic attractiveness of such a processing plant is geared to the prevailing rates of production of the oil with which the gas is associated -- when the oil production is curtailed for prolonged periods the plant might well operate at a net loss since, for reasons beyond the control of the operator, the plant must operate at reduced capacity. In many instances, installation and operation of such a plant is, at best, a marginal financial proposition.

In the case of a processing plant handling gas produced from a gas field, the capacity which must be provided is usually dictated by the terms and provisions of the prevailing gas sales contract. Most gas sales contracts specify a "daily contract quantity" and include provisions whereunder the seller of the gas is obligated, upon request of the buyer, to

supply daily quantities in excess of said daily contract quantity -- the maximum quantity normally being fixed at about 120 per cent of the daily contract quantity. Consequently, capacity must be provided in the plant to meet this obligation even though under the most favourable marketing conditions the buyer of the gas normally is under no obligation to purchase annually more than about 90 per cent of the daily contract quantity. In other words, even when the gas processing plant is supplying a high load-factor market, there normally is no assurance that, on an annual basis, the plant will operate at more than 75 per cent of its design or rated capacity.

A gas processing plant required to be installed for the removal of liquids and hydrogen sulphide contained in gas produced from a gas field entails a large investment. Such a plant must be operated at a high load-factor, both from the standpoint of plant processing efficiency and that of financial return. A low load-factor involves large changes in plant throughput which necessitate frequent changes in the complex operating controls, resulting in abnormally high unit operating costs and reduced process efficiency. The matter of load-factor is particularly critical in those instances where a relatively small portion of the revenue derived by a plant is attributable to the recovered

liquids and other products -- due either to the relatively small quantities available or the limited market for such products. In such instances, the plant operator must, of necessity, rely heavily upon the revenue derived from the sale of residue gas to make his plant operation a profitable venture. Consequently, it is imperative that either the plant be connected to a high load-factor market outlet for its residue gas or require what might be considered a prohibitively high price for residue gas supplied to a low load-factor market. The preceding comment is particularly applicable to the situation which will undoubtedly prevail in the western provinces where large reserves of natural gas containing high concentrations of hydrogen sulphide are being encountered. The added investment required to provide necessary facilities for treating such gas merely serves to aggravate the situation.

At the present time, the only high load-factor market in sight is that offered by major pipeline projects, and, therefore, unless export of surplus gas is permitted, it is virtually certain that large reserves of gas, particularly wet or sour gas, will remain undeveloped -- and the Canadian public will derive no benefits therefrom.

Only three gas processing plants, having a total rated capacity of 130 million cubic feet

daily, were operating in Western Canada prior to 1950 -- these having been placed in operation during the mid-1930's to handle gas produced from the Turner Valley field. During the period 1949 - 57 some $35.8 million was invested in on-the-site gas processing plant facilities. Eleven gas processing plants of varying capacities have been placed in operation in Western Canada since 1950. The total rated capacity of all gas processing plants in 1957 was about 700 millioncubic feet daily. Some 400 million cubic feet per day of this rated capacity is attributable to three plants which are, or will be, supplying gas to the gas transmission lines installed by Westcoast Transmission and Trans-Canada Pipelines. Pertinent data relating to the gas processing plants operating in Western Canada are shown in Appendix II.

It is conservatively estimated that in excess of $100 million will be expended by gas producers during the next three to four years to provide necessary additional facilities to process the anticipated gas requirements of the projects presently authorized for Westcoast Transmission and Trans-Canada Pipelines. This amount is, of course, over and above the significantly larger amounts already spent, and yet to be spent, by the oil and gas industry in making the gas available through exploratory and drilling operations, and for installation

of major gas transmission pipe lines. Construction of such facilities will provide employment for hundreds of workmen; and upon completion, operation of the facilities will provide direct permanent employment for several hundred other persons. In addition, equipment manufacturers, suppliers and service firms will derive significant benefits from such a tremendous program. Further, the availability of additional products which will be derived from processing of the gas will tend to stimulate the demand therefor, and should serve to attract new industry including petrochemicals. In short, the overall economy of Canada will be enhanced through these specific developments -- and for similar expanded developments which will necessarily follow when additional sizeable market outlets are obtained for Canada's surplus natural gas reserves.

THE CHAIRMAN: Thank you, Mr. Thomson. I think, unless you see some objection to it, that possibly we might adjourn at this time, and reassemble at two o'clock.

MR. THOMSON: Very well, sir -- Mr. Chairman, there is just a page and a quarter to read.

THE CHAIRMAN: I see.

MR. THOMSON: Shall I just finish this?

THE CHAIRMAN: Yes, surely. I was looking at the appendices also.

MR. THOMSON: Yes.

Difference in Approach to Transmission of Gas and Oil and the Reasons Therefor: The principal differences in the transmission of gas and oil lie in the methods of transportation and nature of the markets.

Oil can be transported by pipe line, by water, by railway or by road and can be stored at either end. Its ultimate market can be virtually anywhere in the world and it is sold in large quantities to a few purchaser refineries. It can be directed from one market to another as demand dictates.

Gas can only be transported by pipe line, and can at present only be stored in appreciable quantities in a porous underground formation. It is sold mainly to public utility companies at any point along the route who in turn distribute it to a large number of purchasers, who then rely upon it as a factor in their economy and daily life. Once the distributing system has been installed the supply must be maintained and kept in balance with the demand. It does not have the same flexibility of transportation as oil.

When a new oil field is discovered, the producer can immediately start shipping his oil to market by truck, and some revenue is obtained immediately. If the field develops sufficiently, a pipe line to market can subsequently be laid.

Before a gas line can be laid a retail market sufficient to warrant the expenditure must be established at one end, and reserves of gas sufficient to supply that market must be established at the other end. Enough wells to prove the required reserves must therefore be drilled and then shut in until the line is laid. Further in most cases, a plant must be erected to remove any liquefiable hydrocarbons, sulphur, water, or other impurities, which the raw gas may contain and bring the residue gas, thus conditioned, to specifications demanded by the purchaser.

Once a gas trunk line has captured a particular market, it usually holds that market until the reserves at its source are exhausted. Conversely, if a potential market is lost to gas from another source, there is usually little chance of breaking into that market, until the other source has declined to the point where it can no longer supply that market.

THE CHAIRMAN: Thank you very much, Mr. Thomson. We will now adjourn until 2.00 p.m.

---Whereupon the hearing adjourned at 12.15 p.m. until 2.00 p.m.

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AA ---On resuming at 2.00 P.M.

---Mr. Commissioner Hardy and Mr. Commissioner Ladner were not present.

THE CHAIRMAN: Gentlemen, we shall resume our hearing. Mr. Proctor and Mr. Thomson, do you wish to continue and run over these appendices or schedules in the brief?

MR. PROCTOR: Mr. Chairman, I would like to explain what they are; they are statistical data which may be of help to the Commission.

The first table is geophysical operations in Canada, and on the curve on the left side you will see the word Korea.

THE CHAIRMAN: Pardon me, but I am afraid I am not at the same place. What I have is a summary of the Canadian crude oil pipelines.

MR. PROCTOR: We read into the record our statement regarding the difference between the transmission of gas and oil. We then have some statistical tables. The next one is, Summary of Canadian Crude Oil Pipelines. That information is gained from the companies concerned, provided to the Association for statistical purposes.

The next table is: Summary of Canadian Product Pipelines, and the same applies. For the assistance of the Commission, we have included a map of oil pipleines. Then there is a Summary of

Canadian Natural Gas Pipelines, which is followed by a map of gas pipelines.

Then, under Section K of the brief our first exhibit is Geophysical Operations in Canada and the crew months. There is the word Korea on the curve and that, of course, refers to the outbreak of the Korean War, and the step-up of activities in operations.

The next table is, Exploratory Wells Drilled for the period 1951 and 1956, which we have used as a basis for the purpose of this brief. That shows dry wells, gas wells and oil wells. I should point out, in a majority of the cases, those wells were drilled and some turned out as oil and some as gas. They were not, necessarily, drilled as oil wells or gas wells.

Then we have Development Wells Drilled. I think this is an interesting table which shows in a norm reservoir area there are some dry wells, and I would further point out the very small percentage of development gas wells drilled. This small cross-hatch at the top of each column -- that is, of course, because there is a very minor market at the present time for gas reserves.

THE CHAIRMAN: By development well you mean the well is drilled and the driller has found oil or gas, and then they continued to develop it?

MR. PROCTOR: That is right. A wildcat or

exploration well discovers a field or oil or gas, and the development well then follows it up in order to provide additional production from that field.

The next table, Gross Additions to Crude Oil Reserves, and in brackets, (in thousands of barrels). That is the development picture before production.

The next table is, Western Canadian Natural Gas Reserves, and I think that table is self-explanatory.

The next table, Western Canada, Reserves and Production of Crude Oil, (in thousands of barrels). There we show the production, the life index years and percentage withdrawal, and comparing the year 1950 with 1957 you will see the life index year is 42.4, and it goes down to 15.8 in 1957 as gas production has increased. That is, the market has enlarged to reduce the life index.

The next table is Production of Crude Oil (in thousands of barrels), which is statistical data which backs up the comments in the brief.

The next table is, Natural Gas Deliveries to Gas Gathering Systems.

Then we have Expenditure on Petroleum Development in Saskatchewan, 1951 to 1957. I might point out that the source of information for all these tables is -- for example, this is the

Saskatchewan Department of Mineral Resources, and on the next table, Petroleum and Natural Gas Industry Expenditures, British Columbia, the source is the British Columbia Department of Mines.

The next table is Total Expenditures of Firms Engaged in the Petroleum Industry of Alberta, Oil Firms Proper. I might explain that, sir. We do not, for example, include the expenditures of a drilling company or a geophysical company and, similarly, in industry, because the parent oil company pays them, so there would be a duplication of dollars if we included their expenditures in this table; so, it is not there.

The next table, Total Net Cash Expenditures of Oil Firms (Proper) Engaged in the Development of Alberta Oil Resources -- Alberta, 1956. That is in thousands of dollars and that is broken down.

For the assistance of the Board we have included a table of Petroleum Refineries in Canada as of December 31, 1957.

The next table is Daily Crude Oil Capacity of Canadian Petroleum Refineries. This is based on information provided by those various refineries.

The next table is an Estimate of Western Canadian Crude Oil Disposition -- 1957. Disposition differs from actual production due to inventory and loss. That is our best guess of where the oil went.

Then going to Section L of the brief,

Appendix 1 is Rules for Calculating Crude Reserves. It is used by the Association's Reserve Committee and it was referred to earlier this morning.

Appendix 2 is a study of Natural Gas Processing Plants.

THE CHAIRMAN: Thank you very much, Mr. Proctor.

MR. PATTERSON: Mr. Chairman, before we begin with the examination of these gentlemen, I thought it might be convenient to ask Mr. Turner to introduce the various experts who are here.

MR. TURNER: I would be very glad to do that, Mr. Chairman. I will deal with the technical witnesses as they will appear in the witness box and in accordance with the way in which the brief has been presented.

Investments, economics and statistics: Mr. Miller, Mr. Maciej, Mr. Stuart.

Proved and probable reserves: Mr. Connell.

Possible reserves: Dr. Hume, Dr. Erdman and Mr. Axford.

Athabasca bituminous sands: Dr. Hume.

Freehold lands: Mr. Hewitt.

Production and conservation, and also recovery methods: Mr. Bain.

Gas processing: Mr. Edwards.

And as policy witnesses we have: Mr.

Thomson and Mr. Proctor, who are presently in the witness box.

MR. PATTERSON: Perhaps, gentlemen, if I address my questions through you and, if you require assistance, you can call on one of the gentlemen just introduced and, if you do not mind, because of the number of persons named, the person who is expected to answer might just give his name because it is rather difficult for the Reporters otherwise to pick up a voice they have not heard before.

MR. PROCTOR: I wonder, Mr. Patterson, could we deal with the brief by sections and get the proper witnesses? Would that be convenient?

MR. PATTERSON: I can, but I found in my questioning and the things that concerned me, I could not quite allocate them to a section. I was wondering about this problem that we had some discussion on yesterday: it is my understanding that the price of oil is established at consumer level and treating, gathering and transportation costs and so on are deducted to arrive at a fair price at the wellhead. Could you tell me if that is done in the case of gas, or is the producer simply obliged to make the best deal he can with the pipeline, and that deal may, or may not be supported by a definite relationship to consumer costs? That is a sample of the kind of question I could not allocate.

MR. PROCTOR: Mr. Patterson, I am speaking

for the whole industry, and as far as I know the companies make their deals with the pipelines.

BY MR. PATTERSON:

Q. Is there any study or work being done in regard to the problems that arise? Is your Association, for example, concerned in the matter of that type of market situation?

MR. PROCTOR: We have no market studies underway at the present time.

MR. PATTERSON: Thank you, sir. I think I will give you the section and perhaps, then, you can bring the person forward.

I am turning now to Section (b) of the submission, and on page 3 this statement is made: "The investment climate must be kept sufficiently appealing to foster re-investment and to attract new risk capital."

It occurred to me that present state of health of the industry might be measured to some extent by the percentage of exploration and development units such as seismograph and other geophysical crews such as outlined in the graph you have at the end of the brief. I was wondering to what extent you have statistics for the present period and whether you would say, as suggested, the state of health of the industry could be reflected in the number of those units at work?

MR. PROCTOR: Well, speaking generally, Mr. Patterson, we do know the curve of active drilling and geophysical crews has gone down in the last four or five months to a considerable extent. The Canadian Association of Oil Drilling Contractors keeps very close record on that, and, if the Commission so required, I could make this available to you.

Q. Thank you. They are the gentlemen to whom you look for that type of information?

MR. PROCTOR: Yes.

Q. Might we turn, then, to page 4, Section B, and would you elucidate or amplify for me the heading, "Land Acquisition and Rentals." I was wondering if that included lease bonuses.

MR. PROCTOR: I think we will pass the ball to Mr. Maciej and Mr. Miller. Perhaps they can come up here.

Q. Yes. That is "B" at page 4, under the heading, "Acquisition Costs."

MR. MILLER: That is correct. It includes these bonuses.

Q. Turning to page 6 of the same section, you mention, "Prospects for improvement in the marketing picture are a prerogative to the high level of activity in Western Canada oil and gas exploration."

Does your organization share a sufficiently common outlook of possible methods of increasing market outlets to permit you to make studies in regard to possible market outlets?

MR. PROCTOR: Mr. Patterson, there is too much of a divergence of opinion on that point.

Q. Thank you. Turning to page 7, the investment analysis: would you be good enough to tell me where, or on what basis, the item "carrying charge on investment at 6 per cent" is worked out?

On what do you rely for that figure?

MR. MILLER: This analysis was only designed to illustrate the effect of interest. We have, for the purposes of illustration, assumed that the monies invested in exploration and development could have been invested in a low-risk enterprise at 6 per cent.

If this investment were repaid in equal instalments over 20 years, then the interest earned per 81 cents invested would be 61 cents.

Q. Thank you. Under the heading "Operation of Wells," does that include lease costs or is it confined simply to immediate well operation cost in the form you have used?

MR. MILLER: It just contains immediate well operation cost and it would include payment for surface leases.

Q. That is the annual payment?

MR. MILLER: Yes.

Q. Am I correct in assuming that the 2.41 figure of gross income from oil and gas produced is obtained by a division of the amount shown in the income, on page 4, by the amount produced; or, if not, where does the 2.41 come from?

MR. MILLER: That is correct.

Q. Thank you. Turning to page 8 of the investment analysis, the conclusion for the purposes of the illustration would appear to be

that there is a 9 per cent return on investment before taxes. Can you tell me whether a similar study has been conducted in regard to the United States for what the figure might be?

MR. MILLER: I don't believe any similar study has been done in the United States. The Gordon Commission, in the appendix to the energy section, had some figures on that, and I can't recall the figure, but I believe I have the book here.

Q. You think you have a figure for the American position in that?

MR. MILLER: Yes.

Q. Is it, in your recollection, higher or lower?

MR. MILLER: It is 7 per cent, I believe, lower.

Q. Would you like to check that? I am asking you to do my homework.

MR. MILLER: There are two cases: 7 and $7\frac{1}{2}$ per cent.

I might explain also that these are done on a different basis, because the Gordon Commission has taken decline into account. They have also taken increasing costs of producing crude oil.

Q. What you are saying is that we could not, without re-working your figures on the same basis, make any comparison as to the state of the

investment market here in this industry as compared to the American?

MR. MILLER: That is correct.

Q. Might we turn, then, to Part C. I think that is Mr. Connell's sphere.

MR. PROCTOR: Yes. You have no more questions on investment?

Q. I have not, on those, thank you.

Sir, I understand that the CPA releases, from time to time, reserve figures or, at least, makes studies of them. Can you tell me something of the history of the studies that have been made and to whom the figures have been made available?

MR. CONNELL: Estimates of crude oil and natural gas liquids, I believe, were started back in 1950. That was for proved producible reserves only. Those have been done annually and have been released to the public and also have been published in the API and AGA publications which are released on an annual basis. This is the first time that we have calculated probable crude oil and natural gas liquid reserves.

With regard to natural gas, they started that in 1955 and this is the first time that any natural gas estimates have been released.

Q. Now, sir, turning, first of all, to the table, "Estimated Crude Oil and Natural Gas Liquid Reserves," which appears on the first page of

Section C: the rough total for the columns referable to Alberta, under both proved and, I believe you call it, additional probable, is 3.537, and it is my understanding and recollection that the Conservation Board's figure, which does not include a probable, and is simply under the heading of "proven", is 3.1.

Now, my difficulty in understanding differences and discrepancies in these reserve estimates is, I think, one of trying to find out in what sense you used the term "proved and probable" and in what sense they use these terms. Would you assist me there?

MR. CONNELL: From discussions with engineers at the Conservation Board, I am certain that in defining "proved reserves" we have been more conservative than they have been, particularly with regard to areal extent of a partially developed field.

The general rule is that we include only immediate lateral and diagonal offsets of drilled wells in a developed field. In a field where there has been a wildcat that has discovered crude oil we would normally only assign one spacing unit to that particular well. I believe that in the Board's calculation they have been somewhat more liberal in their conception of what is proved reserves and the only reason we are more conservative than they is that we have been trying to keep our estimates on

approximately the same basis as the American Petroleum Institute. We prefer to have these on a conservative basis and make an adjustment in the following estimating period rather than finding it necessary to reduce any of our reserves.

I might say, in that regard, as a general rule the extensions of proved reserves, year by year, are a fairly substantial portion of the total additional reserves each year.

Q. Another way of putting that would be that the extension of proved reserves from year to year would be taken up, in the main, in this additional probable figure?

MR. CONNELL: That is correct. I think, if you analyse our figures and the Conservation Board's figures for Alberta, you will find our total for crude oil, both proved and probable, is 2,922 million barrels and the Conservation Board's is 2,927 million barrels; practically identical.

On natural gas liquids we include condensate as well as propane, butane and gasoline. Our total is 616 million compared to the Board's of 629 million barrels.

Q. And that analysis, that difference in the natural gas liquid reserves, is what gives rise, on this page I was reviewing with you, to the bulk of the difference between you, so that on oil reserves you would say, from your analysis of the

Conservation Board's figures against your own, that while they deal with the category of proved only, that category, in the main, includes the additional probable heading used by you?

MR. CONNELL: There may be some other differences in individual fields; there may be some differences in recovery factors. We do not have the breakdown by fields of the Board's figures so cannot analyse them.

Q. I see. Then, sir, would it be fair to say this, that where you use the term "proved", you are talking about an estimate of oil to be found or to be made by reason of certain mechanical factors and that almost any petroleum engineer would come to the same conclusion as you would, within very narrow limits of discrepancy?

MR. CONNELL: I would think that any engineers looking at it from their company's standpoint would probably come up with a somewhat higher figure than what we have done.

Q. I see. Then, turning to "Additional Probable", in that you are considering what would be expected in the light of general reservoir information and geologic information to be found in the event of extensions from the known or present wells?

MR. CONNELL: That is correct.

Q. When you are thinking of extensions to the discovery wells, you limit that on the conservative side?

MR. CONNELL: That is correct also.

Q. Can we turn our attention to the natural gas reserves, and again because we haven't yet before us anything other than Alberta figures to deal with, we have had from the Conservation Board, first of all, a figure reported by them as at January 31st, 1957, and then the Board made it clear that additional figures were not theirs but those of their staff, and the figure prepared by their staff came to 21 trillion: yours, if my addition is correct, across the board are 26.3 trillion, if I add the two categories "proved" and "additional probable"?

MR. FRAWLEY: Are we to also say "additional probable" as in the case of oil?

MR. PATTERSON: I understood from the reading of the brief this morning that that was correct.

Q. Can you tell me the main reason or reasons for the spread in those two fields?

MR. CONNELL: Yes.

Q. And perhaps elucidate for me again the question of how they do it and what the words "probable" and "proved" mean?

MR. CONNELL: From my discussion with their engineers, I understand that they take proved and approximately, not exactly, 50 per cent. of probable in their calculations. If we take our figures, using the 17.7 trillion as proved, and 50 per cent. of probable would be 4 1/2 trillion, it would give a total of 22.2 trillion, and I would like to explain these are producible reserves. We would still have to make an adjustment for marketable reserves; convert producible reserves to marketable by taking approximately 91 per cent. We have gone through field by field and made an estimate of the marketable reserves, so that, therefore, deducting 9 per cent. from our 22.2 trillion leaves approximately 20.2 trillion cubic feet. I understand that the Board's figure, after deducting reserves presently considered beyond economic reach, would come up to 19.7 trillion as compared to our 20.2 trillion cubic feet. So, I would say our reserves complement those of the Board. I would think if we came up with an estimate within 5 or 10 per cent. we are doing very well.

MR. PROCTOR: If I could add, Mr. Patterson: these were absolutely two independent studies, and neither of us knew the results that would be achieved until the briefs were put in here.

MR. PATTERSON: Q. What you have done is to show me that the difference, where it looks like 5 trillion, actually, when you get down to what you both call marketable reserves, you are within something like one trillion of each other? Do I understand you correctly?

MR. CONNELL: Within half a trillion, when we consider them on the same basis -- that is, from the same areal extent.

Q. When you are considering them on the same basis and from the same areal extent, the figure you get of between 19 and 20 -- I think you gave me a moment ago -- is one of marketable reserves?

MR. CONNELL: Well, we feel that both our proved and probable reserves will be exceeded when additional drilling is undertaken in presently developed fields, but this is all we can justify at the present time from the knowledge we have of those fields.

Q. Yes?

MR. CONNELL: I would like to point out that in numerous cases wildcat wells have been drilled and discovered gas reservoirs, but because

of lack of market at the present time only one well has been drilled to that reservoir. When it becomes economic to market that gas, additional development would be undertaken and it is quite probable many of these single wells or single well fields will actually have very substantial reserves.

Q. Well, sir, could I, perhaps to assist me in making sure I have a proper understanding of these figures, direct your attention to Section J for the moment. There, in dealing with the difference in approaching the transmission of gas and oil, I direct your attention to the last paragraph, and the first sentence there reads: "Before a gas line can be laid a retail market sufficient to warrant the expenditure must be established at one end and reserves of gas sufficient to supply that market must be established at the other end."

Coming back to the figure of between 19 and 20 trillion, am I to take it that when we talk of that as proved reserves they are proved in the sense you talk about, in proving for market, in this paragraph I have reference to?

MR. CONNELL: Yes, that would be correct.

Q. So that, dealing with the next sentence in the paragraph, which says, "Enough wells to prove the required reserves must, therefore, be

drilled and then shut in until the line is laid", the word "prove" in that sentence I can simply equate to the heading "proved" under your tabulation on page 1 of Section C where I see 17.7 trillion?

MR. CONNELL: 17.7 trillion, of course, is a producible figure, not a marketable. Those are figures where there is practically every certainty that that gas will be produced. Undoubtedly, a portion of that which we show as "additional probable" might be considered by certain people sufficiently well proved to justify laying a line or installing a plant in such a field.

Q. But I think on what you have told me, that would not be much more than another 2 trillion?

MR. CONNELL: That came up with the 20.2 trillion on a marketable basis.

Q. Yes?

MR. CONNELL: Where the 17.7 is on producible basis. That would have to be reduced by approximately 9 per cent. to put that on a marketable basis also.

Q. Another way of looking, perhaps, at this word "proved" -- or, let me put it this way: another way of looking at this word we have been discussing, "marketable", would be to say reserves, calculated as you have outlined one would calculate marketable reserves, are reserves of the type on

which sums of money necessary to build a pipeline might be lent?

MR. CONNELL: I would think that would be a reasonable conclusion.

Q. Can you tell me, for the years under study, where there has been a gross increase in crude oil reserves, a rough percentage due to new discoveries as opposed to extension of reserves, or does that appear clearly enough in these tables at the end that I could work it out, which were latterly referred to?

MR. CONNELL: I do not believe those tables give such a breakdown.

Q. No. They simply give me gross additions to crude oil reserves. Could you give me a breakdown at all in percentage?

MR. CONNELL: We could calculate that. It would not be available this afternoon, but such a calculation could be made and supplied to you.

Q. I would appreciate your doing it for me, thank you.

MR. PROCTOR: We will be glad to do it.

MR. PATTERSON: Those are all the questions I have in regard to Part C. Perhaps we could turn now to Part D, and I think that is possibly in your sphere, too.

MR. CONNELL: No, that is Dr. Hume, Dr. Erdman and Mr. Axford.

MR. PATTERSON: Q. Gentlemen, dealing with possible oil and gas reserves, which is section D of the submission, may I turn to the isopach map which, I take it, is the basis of the calculation of the Western Canadian basin minimum possible reserves, and I note that the calculation of the volume of the sediments appears to be between the two major black lines which I think run between the 1000-foot level that parallels the Pre-Cambrian outcrop, and the edge of the foothills which is mentioned as "edge of disturbed belt". Now, may I take it that the foothills are not included in the calculation of the volume of basin sediments?

MR. HUME: No, the foothills are included.

Q. They are?

MR. HUME: Yes. They were calculated separately on the basis of a depth of 16,000 feet.

Q. I see, thank you. On page 2 of Section D you mention in the last sentence dealing with the southwest peninsula of Ontario: "There are many other fields that could be developed for storage and in this the area has a tremendous significance

in relation to transportation of gas from Western Canada for use in Central Canada." Can you amplify that, and can you give us some detail of that, and anything, perhaps, that you know about the storage capacities, and so on?

MR. HUME: The Dawn field in Lambton County has been used for many years for storage, and it is an ideal storage basin. There are a number of other fields in southwestern Ontario, and if you wish the information on that the Geological Survey of Canada has a map particularly showing that, and I can make that available to you. These fields are not depleted to the same extent that the Dawn field is depleted, and until they are depleted they would not be available for storage. I have not got the exact figures of the amount of storage which might be developed there, but it would be fairly large, and the idea of a storage basin is that in the summer time when the demand for gas is low in relation to the winter demand gas could be put in storage and then used during the peak load periods in the winter.

Q. Now, we were discussing a moment ago figures as to proven gas reserves, and then another figure slightly higher for marketable gas reserves, and in this section of the submission -- Section D -- we get another figure which is described as "minimum figures for possible gas reserves", and

those range from 170 to 285 trillion cubic feet. Now, it is rather a long distance between the two figures. Is there any figure between the nineteen and twenty and this very long range estimate that has currency or consideration in the industry, or do you simply go from one right to the other?

MR. HUME: I do not know whether I quite understand your question, sir, but this is a comparison between what might be expected in Canada and what is expected in United States. If you will notice, there is a map that is included in this submission as Figure 1 on page 7, and on that you will see that the Canadian part of the interior plains is an extension northward of the interior plains of the United States, so there is a real basis for comparison, but there are certain considerations which will not allow you to make a direct comparison. For example, the United States has a good deal of tertiary production. We do not expect to find much, if any, tertiary production in the interior basin of Canada, so that there are certain judgment factors that enter into this.

Now, if I might explain the background of this, Mr. Lewis Weeks of the Standard Oil Company of New Jersey has made extensive studies of the amount of oil that might be expected in the volume of sediments in the basins of the United States, and those studies were first published in 1950, and subsequently

he has been making certain revisions of these studies as new information has become available, particularly in relation to the lands that are on the continental shelf. The original figure that he had in the United States was 50,000 barrels of oil per cubic mile of sediments. The world figure that he used was 30,000 barrels per cubic mile of sediments. If you apply those to Canada, which we have estimated at 950,000 cubic miles of sediments, you will come up with this figure of 28.5 if you apply the 30,000-barrel figure, or 47.5 if you apply the 50,000-barrel figure. The 50,000-barrel figure was applicable to the United States, and the 30,000-barrel figure was applicable to the world, as he understood the size of the basins at that time.

At that time in 1950 he had considered that the ultimate reserves of the United States would be 110 billion barrels. Since that time owing to the developments on the continental shelf and other developments he now considers that the ultimate reserves in the United States will be 240 billion barrels. I had a letter from him recently which confirms this figure. That is how the difference arises between those figures of 28.5 and 47.5 billion barrels -- that is, if I understand the question which you are asking.

Q. As a layman I am having some difficulty. Let me put it this way: Dealing with the

gas figures of 17.7 trillion cubic feet and 170 to 285 trillion cubic feet that we have talked about today, you would certainly not suggest that in considering problems of export that we start looking at these 170 trillion cubic feet because we do not know enough about it?

MR. HUME: Well, it is a reasonable -- these are reasonable figures for the ultimate that will be developed in the Western Canadian sedimentary basin.

Q. But we cannot now tie them up to a pipe line or to a contract?

MR. HUME: No, you could never tie probable reserves to financing a pipe line.

Q. So the figures which we have to be looking at in relation to the export problems are figures in the magnitude of 17.7 and 19 to 20 trillion cubic feet?

MR. HUME: Yes, but I might say that unless there is an incentive you will not get these possible reserves developed.

Q. That is, these tremendous amounts that you are talking about?

MR. HUME: Yes. I think we expressed that in the brief here.

THE CHAIRMAN: Would it interrupt your trend of thought, Mr. Patterson, if I were to ask Dr. Hume a question?

MR. PATTERSON: No, sir.

THE CHAIRMAN: Dr. Hume, in the submission which the Conservation Board put before us, and which you have no doubt seen, they estimated the recent increase in gas reserves at the rate of 2.16 trillion cubic feet per year may be related to the 438 wild-cat wells drilled during 1957, and then they went on to say that the Province could safely anticipate a growth rate of 6 billion cubic feet per wildcat well for the next several years, so that when Mr. Patterson says 17 to 19 trillion cubic feet, being the available proven reserves -- between those two figures somewhere -- when you are considering export must you not take into account the probable rate of growth on the basis of experience in the past few years which, according to the figures given to us by the Conservation Board for 1957, was at the rate of 6 billion cubic feet per wildcat well?

MR. HUME: Yes, I think that is right.

THE CHAIRMAN: Do not we bog down if we take -- I am not trying to cross-examine you; I am trying to get enlightenment on this question. Are you justified in only looking at the proven reserves when considering the question of export, or must you not look at the development which experience has shown per wildcat well, if you like, or on an annual basis such as your figure of 2.16 trillion cubic feet, and consider that 17 to 19 trillion

cubic feet less what has been taken out, in so far as more is being taken out than the 2.16 anticipated annually to be added to proven reserves? You have got an increasing volume of proven reserves.

MR. HUME: I think that is so. You get the proven reserves as you drill more wells. It is the wells that will make the proven reserves, in other words.

THE CHAIRMAN: We want help on this question; I am not trying to cross-examine you, but have I stated that fairly correctly, in your opinion?

MR. HUME: Yes.

THE CHAIRMAN: So you should not just look, in your opinion, to the 17 to 19 million cubic feet of proven reserves when considering the amount of gas available for consumption within the Province and export to the rest of Canada and outside Canada?

MR. HUME: I think the industry and, speaking for C.P.A., take the view if the market was available the proven reserves would soon be increased many times what they are. In other words, the incentive for drilling would be there.

THE CHAIRMAN: Would you then agree with the figure which has been given to us by the Conservation Board of that 2.16 trillion cubic feet per year during 1957, 6 billion cubic feet per wildcat well, which they estimate for the next several years to be the case?

MR. HUME: They are speaking for Alberta. We are here dealing with the whole of the sedimentary basin.

THE CHAIRMAN: I am speaking only, at the moment, of the point of view of Alberta. Let us get our bases right. I will read you this paragraph in the Conservation Board's brief, page 81:

"Trends in growth of gas reserves: The recent increase in gas reserves at the rate of 2.16 trillion cubic feet per year may be related to the 438 wildcat wells drilled during 1957. The actual gas reserve growth per wildcat well drilled is just under 5 billion cubic feet. When it is recognized that the 1957 discoveries are not yet nearly fully evaluated this figure confirms the conservatism of the Board's previously reported opinion that the Province can safely anticipate a growth rate of 6 billion cubic feet per wildcat well for the next several years. Such a growth rate, coupled with an estimate of the rate of drilling and the ultimate number of total wildcat wells leads to an estimated ultimate gas reserve of 60 to 80 trillion cubic feet. This figure is on a virgin basis, i.e. includes all production."

I take it, that includes everything already taken out of the ground? I should say --- I was incorrect in saying it was the Conservation Board's estimate. They made it very clear to us it was the estimate of the members of the staff. Could you tell us, and we make this premise, this is Alberta only; would you give us your view as to that paragraph?

MR. HUME: I think that paragraph is correct as far as Alberta is concerned, but I do not believe that on this method that we are inclined to

the basin as a whole. You should take one particular artery and apply the facts to that part of the basin and you apply it to the whole basin.

THE CHAIRMAN: Do you think you should include the whole of the sedimentary basin?

MR. HUME: The figures of the United States are figures that include the whole of the sedimentary basin, and we are applying the same figures to Canada. If you take out an individual part, the part to the thousand-feet contour on the east side of the basin, it would not be considered nearly as good prospecting territory as something further west, so there is the factor that you must either discount one area or multiply for another area if you are going to make a comparison between areas and areas; two different areas. I would say this: the larger the area you take, the more nearly will those figures we give you apply.

THE CHAIRMAN: I am not questioning the figures given by the Canadian Petroleum Association, and I realize perfectly well from the point of view of the Association you give the Canadian picture, but it is made up of various segments, various parts of Canada. I am relating your figures in the brief and carrying them a little bit further, and I am asking if you will agree there is a trend in the growth of gas reserves in Alberta with respect to those Alberta figures in accord with

the estimate given us by the Conservation Board.

MR. AXFORD: May I make a comment? If you take the total gas reserves we have to date in Alberta and divide it by the new field wildcat wells, you get a total per wildcat well of 5.2 billion for all gas which is, generally, in accord with the 6 billion you are discussing and, consequently, we would agree with the Alberta calculation.

THE CHAIRMAN: The 5.2 billion you give, if we read the Conservation Board's brief, it is just under 5 billion, they say, cubic feet with respect to 1957, and they look forward for the next several years to a growth of approximately 6 billion cubic feet.

MR. AXFORD: The figure I have given would reduce the total amount of gas reserves. We have divided by the total of wildcats, and, therefore, covered the last six years of exploration in Canada.

THE CHAIRMAN: So, on that basis, the 6 billion might be a little high?

MR. AXFORD: I would not say that. Alberta, I believe, is finding gas at a rate faster than Saskatchewan and, therefore, their figure would be correct or conservative.

THE CHAIRMAN: Pardon me, the figure you have just given us is ---

MR. AXFORD: For Western Canada.

THE CHAIRMAN: For Western Canada and not related to Alberta?

MR. AXFORD: That is correct.

THE CHAIRMAN: But you would still agree, taking the segment of Alberta alone, you would agree with these figures as being substantially correct?

MR. AXFORD: Yes, sir.

THE CHAIRMAN: I am sorry, Mr. Patterson, I did not mean to interrupt you.

MR. PATTERSON: I think, sir, you short-cut the very problem I was trying to get at.

Q. Turning to page 13 for the moment, paragraph D, I know that the estimate made for the Western Canadian sedimentary basin is said to be of the order of 50 billion barrels, and that is said to be exclusive of the bituminous sands of Northern Alberta. Was there a subtraction from the volume of sediments made for the amount of bituminous sands you were not including?

MR. HUME: No, there was not.

Q. What, approximately, would be the volume of bituminous sands?

MR. HUME: It is very thin at the outcrop, only a matter of a couple of hundred feet. It would be very small; 10,000 to 30,000 square miles 200 feet thick. That is all it would be for the bituminous sands themselves.

Q. Would you say it was an insignificant reduction of the number of cubic miles of sediment?

MR. HUME: Oh, yes.

Q. On page 14 of this same analysis, you say, about the second last sentence from the bottom of the page: "Thus, from the standpoint of both total wells and oil wells drilled, the discovery rate in Western Canada, for its short history, has been better than in the considerably longer period in the United States. Thus, there is a considerable margin of safety in making the assumption that the discovery rate in Canada, for many years to come, will be, at least, the equivalent of what it has been in the United States over a long period."

Is it not correct to say, to quite some extent, the discovery rate for Western Canada has been better than that in the longer period for the United States due to the fact that development in Canada was occurring at a period when there was a great deal more known about methods?

MR. HUME: That is so.

Q. And if you know more, you can shoot a little better.

MR. HUME: That is one reason.

Q. How would you say that affects -- the second sentence, where you say: "There is a con-

siderable margin of safety in making the assumption that the discovery rate in Canada for many years to come will be, at least, the equivalent of what it has been in the United States over a long period."

MR. HUME: The record of three 10-year periods in the United States was compared with the record of a 10-year period in Canada, and in taking the 10-year period we found the record in Canada was considerably better than in the United States.

Q. I quite realize that, but is it better by reason of the fact you knew more about how to discover the oil?

MR. AXFORD: They were using the same methods we are using now. Say, for the last 10 years, we are using the same methods. There is a period of time that comes into consideration. They have been exploring their areas for some 50 or more years, whereas, ours is relatively new.

Q. At the moment, then, they are running into the more inaccessible and rather more difficult areas to find pools of oil?

MR. AXFORD: The Gonzales figures, as quoted in this report, indicated that the rate of finding oil is relatively constant over a 30-year period.

Q. In the United States?

MR. HUME: Yes. I think that is the

reason for the margin of safety.

Q. In dealing with the matter of finding gasfields and the large gasfields that have been found in the United States, is it not true that what you might call the bonanza fields were all found pretty early in the history of the United States development?

MR. HUME: I do not know whether that would be quite a correct statement because at the end of our submission here you find in the last 10 years in the United States they have discovered almost 150 trillion cubic feet.

Q. That 150 trillion cubic feet, has that been allocated as to area or areas of fields? Are we able to say whether that was made up of a great number of small fields or large fields?

MR. HUME: I think they were fields of all sorts. I do not think we made any analysis of the size of those fields.

Q. Would you not agree with the information I have: my recollection is that it is in the FPC docket, No. G5-80. I do not have the work with me, but they suggest that bonanza fields are usually found in the early years of development and not the latter years, and in the period they were considering they were not finding bonanza gasfields. I am asking how you might relate that to probable experience in Western Canada?

MR. AXFORD: I think we have such vast territory not explored yet we are in the bonanza state right now.

Q. I appreciate the comment by Dr. Hume that he did not think it proper to break down between the provinces this overall estimate that you had made. However, I wonder if you would be willing to suggest to me what percentages of what portions of the 3 trillion cubic feet of gas mentioned on page 15 would be likely to be found in Alberta, Saskatchewan and Manitoba?

MR. HUME: We did not make any analysis of that, whatever. I think it could be done but, after all, if it was done it would be a judgment factor.

Q. A judgment figure?

MR. HUME: Yes.

Q. I suggest, in looking at that figure, as with any other figures, for gas we have to make some reservation for the question of dry gas, wet gas, associated gas, sulphur gas, and so on, as to the availability of these various fields.

MR. HUME: If you are making it in terms of marketable gas, that is certainly so.

Q. Can we turn, then, to Section (e), and I think in there there is just one small question, on page 4 in the third sentence, you will see it stated: "The amount of bitumen was found to

vary from a few per cent. to bitumen beds in the sands containing 77.8 per cent. bitumen." Is that a correct figure?

MR. HUME: Yes.

Q. And, if so, on what is it based?

MR. HUME: It is based on actual analysis.

Q. It was my understanding you had in sands or sandstone, a maximum content of approximately 36 per cent. Can you illustrate; those are actual bitumen beds in the tar sands deposit; beds of bitumen.

MR. HUME: They are bitumen with sand in them.

Q. But they are not sand beds with bitumen in the interstices of the sand?

MR. HUME: That is right.

Q. In Section (f) mention is made of the "unless" type of lease and Mr. Turner has furnished me with a typical form of a freehold lease in the Province that I suggest be marked as Exhibit A to today's Exhibit.

---EXHIBIT NO. C-11-1-A: Freehold lease form in connection with submission of Canadian Petroleum Association.

THE CHAIRMAN: Gentlemen, shall we take a break and resume in ten minutes?

---A short recess.

THE CHAIRMAN: Gentlemen, we will now resume our hearings. Mr. Patterson, have you any further questions you wish to address?

MR. PATTERSON: One further question, sir.

Q. Turning to Section G of the submission, dealing with production and conservation, you present, in pages 1 and 2, as well as subsequent pages, a discussion which indicates that the MER's are the upper limits of rates at which reservoirs can be produced so as to avoid waste.

Supposing, however, that the market for Alberta's oil is so increased that it exceeds the total MER for the Province, could the MER's be raised in some fields without damage to the reservoirs concerned? For example, could water injection beneath certain pools such as Redwater and Acheson prevent increase over the present MER's?

MR. PROCTOR: I would like Mr. Bain to answer that.

MR. BAIN: Yes, sir, that is the case. There is a certain slack in Alberta which could be increased by the very method you outline.

Q. In other words, the MER's could be raised by those methods should the market require an increase in sales?

MR. BAIN: Yes, sir.

MR. PATTERSON: Thank you. Those are all the questions I have, Mr. Chairman.

THE CHAIRMAN: Thank you, Mr. Patterson.

Mr. Turner, I am sure you would prefer that Mr. Frawley ask such questions as he would wish, would you not?

MR. TURNER: Yes, I would.

THE CHAIRMAN: Mr. Frawley, have you some questions?

MR. FRAWLEY: Yes. Thank you.

BY MR. FRAWLEY:

Q. Mr. Proctor, would you go to page 16 of Section D and, while it relates to possible oil and gas reserves, my question is a general one which I think can be directed to you. You can tell me, anyway, whether I am right or wrong. There the statement is made, "There is no doubt, therefore, with proper incentives the natural gas industry of Western Canada can have a similar proportional expansion within the next decade."

What are the proper incentives that you would look for and hope for in connection with the natural gas industry in Western Canada and, particularly, in Alberta?

MR. PROCTOR: Economic markets, Mr. Frawley.

Q. Speaking of natural gas, what are the economic markets, in the view of the Canadian Petroleum Association?

MR. PROCTOR: What are the economic markets?

Well, they are markets at which the producer can drill out his fields and sell his gas at a reasonable profit.

Q. Can you put a place and can you locate those markets for me, as you and your Association regard them?

MR. PROCTOR: I am afraid I can't do that, Mr. Frawley. We have no market studies. There are, of course, a number of markets in both Canada and the United States that Alberta gas might serve.

Q. Yes. Now, I may come back to that, in a moment.

In Section I at page 8, you speak of an amount in excess of one hundred million, being expended by gas producers during the next three or four years to provide necessary additional facilities to process the anticipated gas requirements of the projects presently authorized for Westcoast and Trans-Canada pipe lines.

Are you saying there that this money will be spent, whether or not there is any further gas export authorized?

MR. PROCTOR: That is correct, Mr.Frawley.

Q. At the bottom of the same page you say that the overall economy of Canada will be enhanced through these specific developments. Are you also referring to, at the moment, going only to the third last line, are you referring there to

the already authorized Westcoast and Trans-Canada projects?

MR. PROCTOR: That is correct.

Q. But then you go on and speak of, ". . . and for the similar expanded developments which will necessarily follow when additional sizeable market outlets are obtained for Canada's surplus natural gas reserves."

What markets are you speaking of there?

MR. PROCTOR: Any economic markets that can be found and authorized by the regulatory bodies concerned.

Q. You are referring to export markets in addition to the presently authorized Westcoast and Trans-Canada lines?

MR. PROCTOR: That is correct, sir.

Q. Now I want to put to you whether or not there is, in the opinion of your Association, insufficient markets in sight for the natural gas reserves of Alberta, for the proper development of those reserves.

MR. PROCTOR: There are insufficient authorized markets.

Q. I should have said that, because there are only two authorized at the moment, Westcoast, westbound, and Trans-Canada, eastbound, and I am putting to you whether you feel there is a lack of further markets for the proper development of

Alberta's natural gas reserves.

MR. PROCTOR: I would agree with that.

THE CHAIRMAN: Mr. Frawley, the Commission understands there is also a market in Montana, for which there is a licence to export.

MR. FRAWLEY: That is correct. I should have added that.

Q. I will also include, in addition to the Westcoast, westbound, and Trans-Canada, eastbound, the comparatively small market southbound to Montana.

MR. PROCTOR: That is correct.

Q. And then there is a fourth one, I am reminded, trying to get them all in, the Saskatchewan market, eastbound from the Medicine Hat area.

MR. PROCTOR: That is correct.

Q. Now we have all of the authorizations, you say in addition to that there must be further markets found for the proper development of the natural gas resources of Alberta?

MR. PROCTOR: That is correct.

Q. Are you of the view that the lack of market that you are just telling me about is immobilizing much money, much investment capital?

MR. PROCTOR: Yes.

Q. Do you say that the lack of markets is having a real effect upon the money that has already been spent or might be spent in drilling wells?

MR. PROCTOR: Very definitely.

Q. Is there an uncertainty at the moment with regard to the further markets, export markets, for Alberta gas?

MR. PROCTOR: Yes.

Q. Do you say that that uncertainty is discouraging further exploration?

MR. PROCTOR: It is discouraging further exploration for gas.

Q. It is discouraging further exploration and development of gas resources?

MR. PROCTOR: There is very little development of gas resources at the present time, Mr. Frawley.

Q. And why?

MR. PROCTOR: Becuase there is no market other than those which I have already mentioned.

Q. In the light of what you have said, do you feel that there should be a definite national policy with regard to gas export?

MR. PROCTOR: Yes.

Q. Do you feel that a defined national policy is of importance to the development of the natural gas resources and reserves of Alberta?

MR. PROCTOR: I think it is vital, Mr. Frawley.

Q. If a national policy favouring gas export were announced or were to be had, would that result in development of our natural gas resources?

MR. PROCTOR: Would you define "export" for me, Mr. Frawley?

Q. Export to markets in addition to the four authorized markets which you and I have been discussing.

MR. PROCTOR: Yes, I would agree with that.

Q. And you tell me that, in your view, that is a vital matter?

MR. PROCTOR: It is a vital matter, provided the economics are favourable to those markets.

Q. Would the existence, almost in itself, of a national policy favouring export, would that in itself result in the investment of the capital needed to drill out the reserves which we have been hearing about during this Commission within the last few days?

MR. PROCTOR: I think that an owner of a single well in a potential large gas field would like to see a potential market and have some contracts before he would go ahead and build a plant or do additional development drilling.

Q. Wouldn't you say that the uncertainty that you have told me about might be called a cold climate and the announcement of a national export policy would turn that into a warm climate for the development of our natural gas resources?

MR. PROCTOR: Yes, I would agree with that.

I would like to point out that a national policy would certainly assist in the further exploration for gas which, at the moment, is almost at a standstill. As to the development drilling and expenditure for the development of gas reserves, specific markets would have to be in sight before I think a producer would spend those funds.

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Q. It is a fair way to put it, that, take the project of Alberta and Southern: that project was conceived, I think it would seem obvious, upon the proposition that reserves which are not now in the proven class will in the course of time become proven?

MR. PROCTOR: Yes, I believe it is founded on that thesis.

Q. And the Alberta and Southern project is essentially a gas export project?

MR. PROCTOR: That is correct. It is not wholly a gas export project; it also looks after the requirements of the local consumers.

Q. That is right; some at cost and some at 1.3. My friend Mr. Steer corrects me -- "perhaps not any". But, the Alberta and Southern project and the Westcoast project -- the Westcoast project that is presently before the Conservation Board -- is the same kind of project: it is a project which will only be completely successful by the drilling up and the extension of the reserves which the Conservation Board have at the moment said there is in the Province?

MR. PROCTOR: That is correct, and I am glad you added Westcoast, because I must speak for all our companies.

Q. Just apropos of that, I want to have the full value of your answers: in the opening

part of your remarks you said that you would deal only with the subjects on which there is no apparent conflict of opinion or interest amongst your members. So, the answers you have given to me are answers you are quite prepared to give as general manager of the Canadian Petroleum Association?

MR. PROCTOR: I have been bearing that statement in mind when I have been answering your questions.

Q. When I was thinking about some questions I would ask you, I thought I would ask you which were the subjects that you were not going to discuss, but I am not going to ask you that.

MR. PROCTOR: Thank you.

Q. So, as I understand it from you -- and I appreciate very much your answers -- the important thing is the gas that we are going to produce in Alberta beyond what we now have estimated as being the proven reserves?

MR. PROCTOR: That is correct.

Q. And a gas export policy, in your opinion, will bring in the money necessary for an incentive to the development of those reserves?

MR. PROCTOR: That is correct.

Q. Thank you very much. I only have one or two other questions. Probably as far as general questions are concerned, that may be all. However,

I would like to, if I may, direct one or two questions to Dr. Hume and/or Mr. Connell, and probably if they speak loudly and clearly without use of electronic devices, I could leave them where they are.

Mr. Connell, I would like to direct your attention to page 81 of the Conservation Board's statement, and I may say it is precisely the same paragraph that the Chairman was discussing with Dr. Hume, I think. I would like to have the advantage of your opinion as well. I would like to read the opening sentence under the caption: "Trends in Growth of Gas Reserves. The recent increase in gas reserves at the rate of 2.16 trillion cubic feet per year may be related to the 438 wildcat wells drilled during 1957." What is your view as to the importance or otherwise upon the development and the ultimate size of our gas reserves of that statement -- that sentence I have read?

MR. CONNELL: I am not sure whether you are directing this to myself or to Dr. Hume.

Q. I will direct it to both of you.

MR. CONNELL: I might say that our committee, the Reserves Committee, have not made such a study recently as to the rate of increase of reserves. In 1955 we did make a study related to those fields which at that time were dedicated to Trans-Canada, and, applying a similar rate to the

balance of the Province, we came up, as I recall, with a rate of increase of approximately 2.7 trillion cubic feet per year. That was proved and probable. As explained previously, we normally just calculate the proved reserves.

Q. The reason I am directing your attention to this, I want to know whether or not that is an important statement, or that that is an important indicator when one is thinking about the ultimate size of our Alberta natural gas reserves.

MR. CONNELL: I would say such a trend is very important in such considerations.

Q. Mr. Patterson was asking one of the witnesses about large pools -- bonanza pools, as he called them -- in early stages of development: do you know of large discoveries of gas in older pools in some places?

MR. CONNELL: We do know by examining estimates of the American Gas Association of proved reserves of natural gas in the United States, that substantial additions are made to their reserves in old fields. I have reference to this booklet, Proved Reserves, Crude Oil, Natural Gas Liquids and Natural Gas, December 31, 1956, which is a joint A.P.I. and A.G.A. publication. I might point out in the year 1956 the increase due to extensions and revisions in Texas amounted to 6.9 trillion cubic feet of gas, whereas the

remaining reserve at the end of the year was 112.7 trillion cubic feet. In the same year 2.8 trillion cubic feet of gas was attributable to discoveries of new fields and new pools in old fields. The State of Louisiana has shown substantial increases in reserves recently: there a lot of extensions and revisions amounted to 2.9 trillion in 1956, and discoveries of new fields and new pools in old fields amounted to 1.6 trillion cubic feet during that year. At the end of the year the reserves for that State were 45 trillion cubic feet.

Q . Thank you. Now, I would like to address a question to Mr. Connell and Dr. Hume. Reading from page 15 of the Reserves Section of the C.P.A. brief: I am reading from the last paragraph: "Applied to the more reasonable figure of 50 billion barrels, it would be 300 trillion cubic feet." Now, that deals with the whole of the Western Canadian sedimentary basin, and as you may have suspected, I am a special pleader for the Province of Alberta, and I would like to know if it would be possible for you to tell us what portion of the 300 trillion cubic feet might reasonably be expected to be found in this Province?

MR. HUME: I don't think we are in a position to do that at the moment, but we would be glad to make an attempt to do that. Actually,

it is a judgment figure based on our opinion of the quality of the sediments in relation to the amount of gas they might produce. I don't doubt that many people would see that in a different light, and perhaps the three of us will, but we would be glad to come up with some sort of figure for Alberta.

THE CHAIRMAN: I think it would be of great value to the Commission, and we would value your judgment and opinion, Dr. Hume, very much indeed on that, and we would appreciate it if you would let us have that within a reasonable period of time through Mr. Frawley, and you could also make sure that our administrative people get it.

MR. HUME: We will do that, sir.

THE CHAIRMAN: Thank you so much.

MR. FRAWLEY: Q. Mr. Proctor, I would like to direct one more question to you, and it may be just another form of the questions I was asking you a moment ago. Would you say that the further development and exploration will depend primarily on the measure of incentive?

MR. PROCTOR: Yes, certainly.

Q. And that incentive, in your view, is very directly and closely related to market possibilities?

MR. PROCTOR: Yes.

Q. And that applies -- I have been talking gas to you, but that really applies as well to oil?

MR. PROCTOR: I was answering as to oil, sir, as well as gas.

Q. What has been known as the voluntary restriction on imports which have been applied against us in the Puget Sound area has not been an incentive to further development of oil in our Province; that is correct, is it not?

MR. PROCTOR: It has not been an incentive, no, sir.

Q. And if that were translated from what has been called voluntary restrictions on imports into a statutory restriction on imports, as it appears some people would like from what we see in the Press, then your answer would be the same,

that that would certainly be anything but an incentive to the further development of the oil side of our petroleum industry?

MR. PROCTOR: I would agree with you.

THE CHAIRMAN: Mr. Frawley, for the benefit of the Commission, you are referring to statutory restrictions imposed by the United States on imports into that country in that question?

MR. FRAWLEY: I am obliged to you for saying that, sir. I have a bad habit of leaving things like that out of my questions. Thank you very much, sir.

THE CHAIRMAN: Mr. Turner?

BY MR. TURNER:

Q. Mr. Proctor, would you express the views of the Canadian Petroleum Association with regard to exports?

MR. PROCTOR: Yes, Mr. Turner. I have probably been over this with Mr. Frawley, but the views of the Association are that the proven, probable and possible reserves, as published by the Canadian Petroleum Association in this report are sufficiently great that there is a need for an immediate export of oil and gas to economic markets other than the local ones in order to assure the continuing development of these reserves.

Q. So I take it, Mr. Proctor, that

the need for immediate export of oil and gas to economic markets is what you would describe as the necessary incentive?

MR. PROCTOR: That is correct.

Q. Thank you. If I might I will direct a question to Mr. Connell.

Mr. Connell, would you refer to page 2 of Section C of the brief. In the middle of the page, Mr. Connell, it reads as follows: "Experience has demonstrated that proved reserves calculated by these rules are less, overall, than ultimate recovery." Would you comment on that, please?

MR. CONNELL: Yes. I think we have covered this part previously, but as explained before, reserves as calculated by the CPA are definitely conservative, principally due to the areal extent that is assigned to drilled and undrilled private acreage, and we find consistently that following an additional year's development it is necessary to raise those reserves because of the method that we use and rules that we use in calculating the same.

Q. Would you care to give an expression as to the area which has been covered in Alberta, for instance, exploration-wise? Could you give the Commission some percentage of the area within Alberta that has been covered?

MR. CONNELL: That has been explored?

Q. Yes.

MR. AXFORD: Possibly I should answer that one.

Q. Would you answer that?

MR. AXFORD: Our density of exploration in Canada is somewhere ---

THE CHAIRMAN: Would you speak more loudly, please?

MR. AXFORD: Our density of exploration in Canada is small. Considering every well drilled for oil and gas in Western Canada, including shallow and deep wells, we have at the end of 1957 drilled in only one out of every six townships available for exploration. In Western Canada, counting only the wells which have been drilled completely to the sedimentary section -- that is, wells which have gone down to the Pre-Cambrian -- we have drilled in one out of every 600 townships. It is emphasized that in talking of townships we are referring to 36 square miles. By comparison with the United States, Western Canada has one well drilled for every 124 cubic miles of sediment whereas the United States has one well for every 4.2 cubic miles.

THE CHAIRMAN: Can you relate that to Alberta as distinct from Western Canada?

MR. AXFORD: I am sorry; I cannot do that.

MR. TURNER: Q. Would that be possible,

Mr. Axford? Perhaps it is not possible at the moment, but could it be prepared?

MR. AXFORD: It could be prepared, and I think I can give you an arbitrary figure now. I will have to give it to you later. If I might interrupt now, Alberta plains, undrilled townships, are approximately 4,000; drilled townships are approximately 1,900: Alberta foothills; drilled townships -- I will give them in the same order as I gave the Alberta plains -- Alberta foothills; undrilled townships, 480; drilled townships, 65.

THE CHAIRMAN: Thank you.

MR. TURNER: Can I direct another question to you, Mr. Axford? Our proven gas reserves for Alberta are in the vicinity of 17 to 18 trillion cubic feet which, as you have indicated just now, are a result of exploration work in a limited area, and I ask you what your thoughts would be ---

THE CHAIRMAN: I am sorry, Mr. Turner, but you will have to speak more loudly. Perhaps Mr. Axford would move over here so that you may address your question this way and the reporter may be able to hear you.

MR. TURNER: I am sorry, sir.

Q. What would your thoughts be, Mr. Axford, if a greater percentage of the area was covered by exploration work?

MR. AXFORD: In what respect -- pardon me?

Q. As to production and reserves?

MR. AXFORD: With reference only to Alberta?

Q. Yes.

MR. AXFORD: Oil or gas?

Q. Both.

MR. AXFORD: I have here a figure for average reserve discoveries per well and by province from 1952 to 1957. It indicates a reserve discovery per well for Alberta and British Columbia of 310,000 barrels per well; Saskatchewan, 167,000 barrels per well; and Manitoba, 71,000 barrels per well. For all provinces the figure is 250,000 barrels per well. These figures indicate that in an oil sense Alberta and British Columbia are finding a much greater proportion of the oil. Consequently, taking Dr. Hume's figures, or the figures from Dr. Hume's committee, of ultimate reserves of somewhere near 50 billion barrels Alberta might have something in the order of at least one-half. Is that a sufficient answer?

Q. Thank you. Would you give us your comments on the gas, please?

MR. AXFORD: Once again, without further calculations we cannot give any reasonably accurate figure for such an estimate. However, using the oil calculations upon which I have just commented, and on the basis of past history where you have not found much gas in Saskatchewan, you would expect that

the ratio to overall reserves of gas in Alberta would be much higher than for oil.

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Q. Mr. Chairman, this morning you requested a breakdown of the gas under the headings of associated, non-associated and dissolved, and we have had this prepared since your request was made.

THE CHAIRMAN: Thank you, Mr. Turner. Could they be put in as exhibits?

MR. TURNER: Yes, sir, I will put them in as exhibits.

THE CHAIRMAN: Before we number this exhibit, I wonder if we might have the United States report which Mr. Connell referred to and read from put in as an exhibit, and it would be numbered prior to this exhibit.

MR. PATTERSON: The United States report then would become C-11-1-B, and the statement of proved recoverable reserves broken down under various headings, Exhibit C-11-1-C.

---EXHIBIT NO. C-11-1-B: United States Report referred to.

---EXHIBIT NO. C-11-1-C: Statement of proved recoverable reserves referred to (both in connection with submission of C.P.A.)

MR. TURNER: Mr. Chairman, I will ask Mr. Connell to comment on the figures that are in this table.

MR. CONNELL: I thought we might just

look at these figures, particularly, in relation to Alberta. This is with reference to proved recoverable reserves only; we have not made a similar breakdown of probable reserves, but out of the 17.7 trillion proved remaining in Alberta 11 1/2 trillion, or approximately, 65 per cent. is in the non-associated category. 21 1/2 per cent. is in the associated category. 13 per cent. in dissolved and a small amount in underground storage. So, the vast majority of the gas in Alberta is available for market with also, at least, a portion of both the associated and dissolved gas. I think, also, you might be interested in these figures as well: of the proved remaining 20.7 trillion, 13.7 trillion is in non-associated; 4.2 associated, and 2.8 in dissolved, and 30.3 billion is in underground storage.

THE CHAIRMAN: Thank you very much.

BY MR. TURNER:

Q. Mr. Connell, at the beginning of Section (c) of the brief and throughout your section on reserves, you give certain figures relative to oil and gas. Would you say they were producible?

MR. CONNELL: These are producible estimates.

Q. And what portion of each is marketable?

MR. CONNELL: In regard to crude oil, practically all; practically 100 per cent. is marketable. In regard to the gas we have estimated available, approximately 91 per cent. of both the proved and additional probable would be marketable.

Q. Have you taken into consideration whether or not this gas is within economic reach?

MR. CONNELL: Yes, we have. In considering the marketability we eliminated fields we felt are not presently within economic reach.

Q. Mr. Connell, are you aware of the Conservation Board's estimate as to trends of increases and gas discoveries in each year?

MR. CONNELL: Yes, I am. I have read the report and I have seen their graph on discoveries.

THE CHAIRMAN: May I ask what this report is?

MR. CONNELL: This is the Conservation Board's submission to the Commission. I have particular reference to figure M-F in the Conservation Board's submission. Dr. Govier went through this and explained it in detail. I think we might just re-emphasize the fact that even fields discovered years ago have had extensions proven within the last few years which has added to the proved reserves, and, as they call it, disposable reserves, and I think that is quite significant in looking at reserves

that any figures, either the Board's or C.P.A. Reserves Committee come out with at the present time must definitely be considered to be reserves.

Q. Has the C.P.A. prepared a comparable figure?

MR. CONNELL: No, we have not. We have not been estimating the reserves for as long as the Board have and our reserves are only on proved basis. We have not dealt with proved and probable except for the present Commission and for a portion of the Province of Alberta during 1955.

Q. Do I understand you to say the Conservation Board was a conservative figure?

MR. CONNELL: I believe my statement was -- this graph illustrates this -- the Conservation Board figures and our figures are definitely conservative.

Q. What, in your opinion, would increase the annual rate of growth?

MR. CONNELL: Actually, the increase in proved areal extent of fields has additional development where drilling is undertaken; that is, referring to fields that have been discovered in the past and as additional drilling is undertaken the areal extent is enlarged.

MR. TURNER: Mr. Chairman, I would like to direct a question to Dr. Erdman.

Q. Dr. Erdman, are you of the opinion

that proved and probable reserves as stated in this report, the C.P.A. submission, are the only reserves which can be considered as fundamental to the projected development of oil or gas export?

MR. ERDMAN: I would say definitely, in any fair valuation of the potential of a country, especially a country in the state of development of Western Canada or Alberta, there are many wildcat fields that require development before they are fully evaluated. In addition to that, there are the possible reserves Dr. Hume referred to, the subsequent reserves, in case the potential is there. This requires only exploitation or development to bring the reserves up to a larger figure, so in any discussion of gas export or oil export, one should not forget the huge reserve behind us of probable and proven as evaluated by the production market and engineers. I feel, and I think I speak for the C.P.A., the possible reserves and the background, which should mean an increase from year to year, they require incentive before they are developed.

MR. TURNER: That is all I have but I believe Mr. Taylor might have one or two questions, if you will bear with us, Mr. Chairman.

THE CHAIRMAN: The Commission have one or two, also.

BY MR. TAYLOR:

Q. I would like to direct a question to Mr. Bain. In Section H of the submission you have developed at some length the question of secondary recovery, injection recovery, and so on, and I wonder if you could say something about the results which are obtained from such methods? In other words, you indicate a percentage figure by which the recovery of oil is increased: could you give us some figures in barrels; take, for example, a single well or field in which these methods were applied, what would the results be in barrels of recovery?

MR. BAIN: As was pointed out in this section, the range of increase in recovery, by instituting injection projects, will vary from a very few per cent up to 30 per cent of the original in place. As an average, we have indicated somewhere between 10 and 15 per cent of the probable oil in place in Western Canada can be rendered recoverable by injection recovery, or secondary recovery projects, whichever you wish to call them. In terms of a single well in a solution gas drive field, this may double the reserves of that well, and, in effect, the secondary recovery or injection projects might, in a sense, actually create a whole new field, or the reserves of a whole new field.

Q. In other words, the application of these methods would be similar to the discovery of a

new field?

MR. BAIN: Yes, sir.

MR. TAYLOR: I would like to ask Mr. Erdman a question.

Q. In Section I, on page 1, it is stated that gas produced in its natural state normally is not suitable for pipeline transmission over long distances: could you make a statement as to the reason you use that term "not suitable"?

MR. ERDMAN: Well, as pointed out in the brief, gas which is produced in its natural state contains varying amounts of liquid hydrocarbons as well as water vapor and other impurities such as hydrogen sulphide and carbon dioxide. With regard to the water vapor, it is objectionable from the standpoint that it causes freezing, and by condensation in a pipe line it reduces the capacity of the pipe line. In addition, it contributes to the corrosion of the equipment. With regard to the hydrogen sulphide, it is extremely, in the first place, corrosive. In addition it is extremely toxic in nature; it is poisonous in very little concentrations. In addition, if the hydrogen sulphide were the only objectionable constituent in a gas that is produced, its removal would be necessitated from the standpoint that when the hydrogen sulphide-bearing gas was burnt it would produce sulphur dioxide which has an extremely irritating effect.

In addition, the hydrogen sulphide, when exposed to traces of oxygen tends to promote a deposition of objectionable quantities of elemental sulphur in equipment. The carbon dioxide, in itself, is not particularly objectionable except in two instances, one being in the presence of water it is quite corrosive, and in the other instance when present in significant quantities it serves to reduce the heating value of the natural gas. The water vapor and hydrocarbon liquids, when present in significant quantities, will condense and drop out in our systems and also reduce the capacity of those systems, and, in addition, it would cause slugging of liquids along the gas bays to furnaces and cause an explosion. So, for those reasons, it is necessary these materials be removed from the gas before being introduced into a pipe line.

MR. TAYLOR: Thank you very much.

MR. TURNER: That completes our submission, sir.

THE CHAIRMAN: Thank you very much, Mr. Turner.

Mr. Erdman, I think probably you are the man, although I may be quite incorrect, and therefore I will address my question to Mr. Proctor. In Section C there is a table of proved and probable sulphur reserves in which it shows that the estimate of remaining proved reserves of sulphur, as of

December 31st, 1957, in Alberta is 28,092 long tons: does your Association know how these are going to be disposed of -- how this sulphur will be disposed of; what the market for it is?

MR. PROCTOR: No, sir, we have no studies on that, but we know some of our companies are studying it. I have no overall information for you; I doubt very much if I could get it.

THE CHAIRMAN: Does the existence of these large quantities of sulphur, and your having to extract them from the natural gas, as we have just heard, to transmit the gas over long distance transmission lines -- is that a deterrent to the utilization and development of those fields where the gas is contaminated by this sulphur dioxide, having regard to the market facilities?

MR. PROCTOR: It is not a deterrent. It is hoped a market will be found for that sulphur. I don't think any company at the present time considers in its economics the very high price for sulphur.

THE CHAIRMAN: Would you say, as you did with gas and oil, that an economic market must be found for it?

MR. PROCTOR: No, not necessarily.

THE CHAIRMAN: In other words, it might be dumped as a by-product?

MR. PROCTOR: It could be, sir. It is

not vital.

THE CHAIRMAN: It is not vital to the development of the gas fields?

MR. PROCTOR: That is my opinion, sir, yes.

THE CHAIRMAN: Section G, Mr. Proctor, page 4 of the submission: there is a tabulation with respect to oil, giving the average 1957 production rate and productivity for each of the four western provinces. Would you be good enough to tell the Commission, in your opinion, why the average production rate in relation to the average productivity in barrels per day of the Province of Saskatchewan is so much bgreater than the Province of Alberta?

MR. PROCTOR: The Province of Saskatchewan is closer to the market.

THE CHAIRMAN: And that market is what -- the Interprovincial Pipeline? Is that the answer to that?

MR. PROCTOR: Yes, that is the answer.

THE CHAIRMAN: I believe you had written down the answer to the question as to what the policy of the CPA is with respect to export. Mr. Turner asked you the question, and I think you read it.

MR.PROCTOR: Yes, I did.

THE CHAIRMAN: If you don't have it written, or didn't speak exactly from the way you had it

written, we will have to get the reporter back to read it.

MR. PROCTOR: I have it here.

THE CHAIRMAN: Would you mind repeating it again?

MR. PROCTOR: Proven, probable and possible reserves as published by the Canadian Petroleum Association in this report are sufficiently great that there is a need for an immediate export of oil and gas to economic markets other than the local markets in order to assure the continuing development of these reserves.

THE CHAIRMAN: Thank you very much. Would you mind telling us what you mean by "local markets"? You have referred on page 8 of Section I, at the bottom, to Canada's surplus natural gas reserves. Mr. Frawley read that sentence to you, and I assumed your local markets, in your policy exposition, would mean Canadian markets?

MR. PROCTOR: No, sir. By"local markets" I mean markets perhaps within 100 miles of the gas fields in British Columbia, Alberta and Saskatchewan. We have no market study of the requirements of Eastern Canada for Western Canada's natural gas. We can give no opinion on that.

THE CHAIRMAN: Well, you have included oil in this.

MR. PROCTOR: We have a pretty good idea of the oil markets, yes.

THE CHAIRMAN: Would you say that in including oil that the CPA would agree that the existing markets in Canada, wherever they may be, for oil and gas must first be protected before export out of the country of either product?

MR. PROCTOR: I am afraid the CPA can give no opinion on that. There is a difference of opinion among our various members.

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THE CHAIRMAN: Have you any questions?

MR. COMMISSIONER CUSHING: Mr. Proctor, in the introduction of your submission you say that the Association has some 274 exploration and producing companies and then you say the Association also has 63 associated member companies whose business is ancillary to the search for and production of oil and gas.

Now, in very general terms could you give us a breakdown of some of that ancillary membership?

MR. PROCTOR: Yes, sir. They are legal firms that are interested in oil; accounting firms, banks, some land companies.

MR. COMMISSIONER CUSHING: Does it include any refineries and pipeline transmission companies and so on?

MR. PROCTOR: We have a pipeline section of the Association but no refineries. We do not represent the refining industry.

MR. COMMISSIONER CUSHING: Are the pipeline companies part of the 274 membership or the 63 membership?

MR. PROCTOR: Of the 274 membership.

MR. COMMISSIONER CUSHING: They are direct membership?

MR. PROCTOR: They are active membership. I should add that we have members who also have refining facilities, but they are not members -- we

do not represent them as refineries, at the present time.

MR. COMMISSIONER CUSHING: A, a national assocation representing the petroleum industry, I am sure you have many problems, as all national associations do. What, in your opinion, is the most pressing problem of the Canadian Petroleum Association?

MR. PROCTOR: The most pressing problem is to find sufficient markets for Alberta oil and gas.

MR. COMMISSIONER C SHING: Would either of those be a more pressing problem than any other one?

MR. PROCTOR: Well ---

MR. COMMISSIONER CUSHING: Is gas the more pressing problem or is oil the most pressing problem?

MR. PROCTOR: Let me put it this way: oil is a worldwide commodity. It seems difficult to find quick, additional markets for our oil. We do think that there are additional immediate markets for our natural gas, so our pressing problem is probably our gas problem.

MR. COMMISSIONER CUSHING: Now, Mr. Frawley developed with you, in great detail, the gas problem and, as I understood it, you were of the opinion that there should be a national policy

in connection with the export of gas, and then I think he also added oil. Is that right?

MR. PROCTOR: I thought we were discussing gas at that time.

MR. COMMISSIONER CUSHING: All right. Then you believe there should be a national policy on gas?

MR. PROCTOR: Yes.

MR. COMMISSIONER CUSHING: Do you feel the same way about oil?

MR. PROCTOR: I am afraid I cannot answer for these 274 people on that question.

MR. COMMISSIONER CUSHING: Then, as a national association, when we talk of export, I would presume you would mean out of Canada, is that right?

MR. PROCTOR: Not necessarily; no.

MR. COMMISSIONER CUSHING: Then you would be talking as a Provincial organization if you talked about export out of any one province?

MR. PROCTOR: We have only referred to our studies on reserves in Western Canada and our potential reserves. We feel that an economic market must be found. We have no way of knowing whether that market exists completely in the remainder of Canada or whether additional markets must be found outside Canada.

MR. COMMISSIONER CUSHING: Then it

would be an export out of Western Canada?

MR. PROCTOR: That is correct.

MR. COMMISSIONER CUSHING: On page 3, the Chairman asked a question in this same connection, a minute ago, on G at page 3. You are talking about productivity and prorating and the policies of the Provincial Governments, and the last sentence of the first paragraph says: "Prorationing is not yet considered necessary by the other Provincial Governments."

Has the Canadian Petroleum Association taken a position in this connection?

MR. PROCTOR: No.

MR. COMMISSIONER CUSHING: Do you feel, again, it might be beneficial to have a national policy on prorationing for Canada?

MR. PROCTOR: I am afraid I cannot answer that question, at this time.

MR. COMMISSIONER CUSHING: That is another one of the controversial questions within the membership?

MR. PROCTOR: That is correct.

MR. COMMISSIONER CUSHING: Maybe I am asking all the embarrassing questions that were left out of the submission.

On the matter of Item J, you discussed the transmission of gas and oil and one of the questions referred to this Commission is to deal with

problems involved in the regulation of the transmission of oil and natural gas between provinces or from Canada to another country.

Has the Canadian Petroleum Association taken or made any policy or expressed any opinion as to whether there should be a national policy on the transmission of oil and natural gas between provinces of Canada or to another country?

MR. PROCTOR: Well, Mr. Cushing, I think I can say this, that we are not so concerned who has the jurisdiction over these pipelines as long as a clear jurisdiction is established.

MR. COMMISSIONER CUSHING: Those are all the questions I have.

THE CHAIRMAN: Mr. Howland, have you a question?

MR. COMMISSIONER HOWLAND: No, thank you.

MR. PROCTOR: There is some confusion at the present time.

THE CHAIRMAN: Yes, I think so. I think you have understated it.

MR. COMMISSIONER BRITNELL: I think, Mr. Chairman, the only one of my questions remaining unanswered had reference to Section J, the first sentence on the top of page 2: "Once a gas trunk line has captured a particular market it usually holds that market until the reserves at its source are exhausted."

We heard, yesterday, an expert analysis or opinion that gas must face the prospect of losing a fairly significant portion of its market in Alberta to heavy oil and even to coal. I wondered whether it would be fair to assume that the Canadian Petroleum Association would not subscribe completely to this view.

MR. PROCTOR: Well, sir, I feel that gas is a very high quality fuel and may be replaced at certain market areas, and by that I mean as boiler fuel -- in other words, it is a high quality fuel and, as it can find high quality markets, it may back off and coal or fuel oil replace it.

THE CHAIRMAN: I think what Dr. Britnell was referring to -- and he can correct me if I am not assuming accurately -- yesterday we were told that by 1960, because of the dieselization of the railroads, they would lose 15 per cent. of the heavy oil and that the refineries would take the oil to fire, instead of gas.

MR. COMMISSIONER BRITNELL: Yes, and that there were certain other areas of the market which would use coal because it would become economic to do so.

MR. PROCTOR: I feel unqualified to answer that question, Dr. Britnell.

I wonder if any of our other experts would like to have a shot at it? It is really a refining

question.

MR. FRAWLEY: Mr. Chairman, I know it is very late, but I would like to ask one question, because I thought there was some lack of the meeting of minds between Mr.Commissioner Cushing and Mr. Proctor.

I made a note that you told Mr. Commissioner Cushing that you did not think we needed a national policy with respect to oil. Perhaps I did not understand it. If I did, I want to put this to you: you feel that a natural market for Alberta oil is the Puget Sound area at the end of the Trans-Mountain line, do you not?

MR. PROCTOR: I can't answer that question.

MR. FRAWLEY: Ah, well, then, I think you misunderstood me.

MR. PROCTOR: Yes. Did I say that?

MR. FRAWLEY: Well, I would like a little more indulgence, Mr. Chairman.

Why do you say you do not think that the Puget Sound market, with the Trans-Mountain branch lines going right into that area, why do you say that is not a natural outlet for Alberta oil?

MR. PROCTOR: I didn't say that. I say it is an outlet. It may not be the only outlet.

MR. FRAWLEY: I didn't catch that last remark.

MR. PROCTOR: The Puget Sound area is certainly an outlet for Western Canadian oil, and a good one.

MR. FRAWLEY: At the moment, we are in danger of not enjoying it any more. Is that not also true?

MR. PROCTOR: We have still got a considerable percentage there.

MR. FRAWLEY: I am talking about the danger that the voluntary restriction may be turned into a statutory restriction, and that would not be any good for our Alberta oil, would it?

MR. PROCTOR: No, that is correct.

MR. FRAWLEY: I put it to you that we are badly in need of a national policy as to whether or not our oil would get into that area.

MR. PROCTOR: That would be a very desirable market for our oil.

MR. FRAWLEY: And wouldn't it be a very desirable incentive, at the national level and all other levels, to do everything possible to get our oil into that area?

MR. PROCTOR: I would agree with that.

MR. FRAWLEY: To that extent do you agree, then, that we should have a united policy with respect to oil?

Are you a little fearful to agree with that?

MR. PROCTOR: I have got 274 people ---

MR. FRAWLEY: Yes, but you will at least go as far with me as you went, up to the last question?

MR. PROCTOR: That is a very desirable market, Mr. Frawley, certainly.

THE CHAIRMAN: Mr. Proctor, since Mr. Frawley brought that up, would you add the words, "as well as any other area"?

MR. PROCTOR: I certainly would.

MR. FRAWLEY: Yes. There is a place called Montreal that people talk about.

MR. COMMISSIONER CUSHING: It cannot be a one-way road, Mr. Frawley. It has to go both ways.

THE CHAIRMAN: Mr. Proctor, thank you very much indeed, you and Mr. Thomson and Mr. Turner and Mr. Taylor and Dr. Hume and all your colleagues. This has been a most interesting and valuable presentation that you have given the Commission, a most informative and enlightening one, and we are all very grateful to you and your colleagues. We thank you not only for all the work and thought that has gone into the preparation of your brief but also for the co-operation which you and your colleagues have shown the Commission, through its administrative staff, in arranging these hearings and other matters and, also, in coming today and changing your plans.

MR. PROCTOR: Thank you very much, Mr.

Chairman. May I say that if we can be of any further help, please do not hesitate to call on us.

THE CHAIRMAN: Gentlemen, the hearings are adjourned until 9.45 tomorrow morning.

---Whereupon the hearings adjourned at 5.00 P.M., until 9.45 A.M., Wednesday, February 12, 1958.

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